38606
Vol. 3

# Union Pacific Railroad Yard
# Sacramento, California

# DRAFT
# REMEDIAL ACTION PLAN

NOVEMBER 1991

Submitted By

UNION PACIFIC RAILROAD COMPANY
1416 Dodge Street, Room 930
Omaha, Nebraska 68179

Prepared By

DAMES & MOORE

UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA
**DRAFT REMEDIAL ACTION PLAN**

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UNION PACIFIC RAILROAD COMPANY
1416 DODGE STREET, ROOM 930
OMAHA, NEBRASKA 68179

PREPARED BY:
DAMES & MOORE

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November 4, 1991

Mr. Val W. Siebal, Regional Administrator
Region 1, Department of Toxic Substances Control
California Environmental Protection Agency
10151 Croyden Way, Suite 3
Sacramento, CA 95827-2106

Attention: Mr. James L. Tjosvold, Chief
Sacramento Responsible Party Unit
Site Mitigation Branch

RE: Draft Remedial Action Plan
Union Pacific Railroad Yard
Sacramento, California
Job No. 00173-064-044

Dear Mr. Tjosvold:

Union Pacific Railroad Company (UPRR) has requested that Dames & Moore transmit the enclosed Draft Remedial Action Plan (RAP) for the UPRR Yard, Sacramento, California. This Draft RAP has been prepared pursuant to Enforceable Agreement No. HSA 86/87-015EA issued March 26, 1987 to UPRR by the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC, formerly the California Department of Health Services - DHS), as modified by DTSC correspondence. The organization and contents of the Draft RAP are in conformance with the DTSC required format for Draft RAP documents (DTSC Official Policy/Procedure No. 87-2). Included in the Draft RAP is a summary of the Remedial Investigation, the Feasibility Study, the Health Risk Assessment, and the conceptual clean-up plan for the site.

If you have any questions regarding the enclosed document, please contact me at (916) 387-8800.

Sincerely,

DAMES & MOORE

Timothy K. Parker
Project Manager

Enclosure

cc: Distribution List

**DISTRIBUTION LIST:** **UNION PACIFIC RAILROAD YARD**
**SACRAMENTO, CALIFORNIA**
**JOB NUMBER 00173-064-044**

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November 4, 1991

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DRAFT
REMEDIAL ACTION PLAN
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

## Table of Contents

## LIST OF TABLES



## LIST OF FIGURES

LIST OF APPENDICES

DRAFT
REMEDIAL ACTION PLAN
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

## 0.0 EXECUTIVE SUMMARY

Presented in this Draft **Remedial Action Plan**[1] is information on the proposed remedy for soil and groundwater contamination discovered at the Union Pacific Railroad Yard located in Sacramento, California. This Draft Remedial Action Plan has been prepared by Dames & Moore on behalf of Union Pacific Railroad Company (UPRR), pursuant to Enforceable Agreement No. HSA 86/87-015EA issued to UPRR by the California Environmental Protection Agency-Department of Toxic Substances Control (DTSC) on March 26, 1987. A Remedial Action Plan is required by California Health and Safety Code Section 25356.1 as part of the **clean-up** process for state-listed **hazardous substances** release sites. The purpose of this Draft Remedial Action Plan is to summarize clean-up investigations undertaken at the UPRR Yard Sacramento site and to present the proposed conceptual clean-up strategy. The Remedial Action Plan approval process is the means by which the public is provided an opportunity to be involved in the hazardous substances release site remedial action decision-making process.

Historical information indicates that the Western Pacific Railroad (WPRR) operated a railroad maintenance yard at the site commencing in 1910. From 1910 through the mid-1950s, the site was used primarily for maintaining and rebuilding steam locomotives, boilers, refurbishing rail cars, and assembling trains. During the mid-1950s, diesel engine repair and maintenance began. In 1982 UPRR acquired WPRR. UPRR discontinued railroad maintenance operations at the site in 1983, and remaining railroad maintenance buildings and structures on the site were demolished by UPRR in 1985 and 1986.

Currently, no railroad maintenance activities are conducted at the site. The site has been divided into an inactive eastern portion, and an active western portion. The inactive portion of the site is fenced, unoccupied, and is the area of the site where most of the former railroad maintenance activities were conducted. The active portion of the site is occupied by a switching area for transferring cars between trains, the main active track, and an office building for Sacramento railroad operations. Investigations of the active portion of the site have not been completed, and a clean-up strategy, should any clean-up be necessary, will be provided in a separate document for the active portion of the site.

A **Remedial Investigation** conducted at the site revealed the presence of railroad maintenance contaminants and materials in the site soils, including the metals arsenic and lead, petroleum hydrocarbons, and construction rubble and debris. Elevated levels of metals were also detected in one

[1] All terms shown in bold type are defined in the Glossary in Section 11.0.

environment than those final candidate alternatives which require excavation of all contaminated soil, (5) use a demonstrated and proven technology, and (6) provide adequate overall long-term protection of human health and the environment. This is the most cost-effective of all applicable alternatives for this Operable Unit, with the exception of the No Action alternative.

Alternative 6, Excavation/Off-Site Disposal of Hot Spots With Capping, was selected as the recommended remedial alternative for soil Operable Unit S-3. This alternative consists of excavation and off-site disposal of highly contaminated soils, construction of an asphalt cap to cover lesser contaminated soil, constructing and/or repairing a fence around the site to restrict access, repairing and replacing portions of the asphalt cap as necessary, conducting groundwater monitoring, and preparing a land use covenant which would be noticed on the deed to the property to regulate future land uses and activities on the property so that the contaminants are not disturbed. This alternative will (1) effectively eliminate the primary exposure pathways, (2) significantly reduce downward movement of rainwater through contaminated soils, thereby providing good groundwater quality protection, (3) provide better short-term protection of human health and the environment than those final candidate alternatives which require excavation of all contaminated soil, (4) use a demonstrated and proven technology, and (5) provide adequate overall long-term protection of human health and the environment. This is the most cost-effective of all applicable alternatives for this Operable Unit, with the exception of the No Action alternative.

Alternative 10, Excavation/Off-Site Disposal of Soil Above **Remedial Action Objectives**, was selected as the remedial alternative for soil Operable Unit S-4. This alternative consists of excavation and off-site disposal of contaminated soils above remedial action objectives. This alternative will (1) effectively eliminate the primary exposure pathways, (2) provide adequate overall long-term protection of human health and the environment through reduction of mobility, toxicity, and volume of contaminants, and (3) be reasonably cost-effective.

Alternative 4, Extract, Treat, and Discharge, was selected as the remedial alternative for groundwater Operable Unit GW-1. This alternative consists of the extraction of contaminated groundwater, treatment, and discharge of the treated water to the sewer. Also included are groundwater monitoring and restrictions on the number and type of permits for the drilling of groundwater wells in the area of Operable Unit GW-1 during groundwater remediation. This alternative will (1) provide the greatest protection of human health and the environment, (2) reduce the toxicity, mobility, and volume of contaminants, (3) use demonstrated and proven technologies, and (4) provide the long-term advantage of meeting remediation goals.

Alternative 2, Limited Action, was selected as the remedial alternative for groundwater Operable Unit GW-2. This alternative consists of 30 years of groundwater monitoring, and restrictions on the number and type of permits for the drilling of groundwater wells in the area of Operable Unit GW-2. This alternative will (1) limit the potential for exposure to contaminated groundwater, (2) provide better short-term protection of human health and the environment than other final candidate alternatives, and (3) provide good long-term effectiveness because of low contaminant concentrations and limited extent. This is the most cost-effective of all applicable alternatives for this Operable Unit, with the exception of the No Action alternative.

Total implementation times (from submittal of the Draft Remedial Action Plan to DTSC to the end of field activities) for the selected soil remedial alternatives for soil Operable Units S-1, S-2, and S-3 are anticipated to be approximately 24 months. The selected alternative for soil Operable Unit S-4, Excavation/Off-Site Disposal of Soil, has already been completed. The total time (commencing with the submittal of the Draft Remedial Action Plan to DTSC) for the design and installation of the groundwater remediation system for groundwater Operable Unit GW-1 is expected to require approximately 18 months. Implementation of the selected alternative for groundwater Operable Unit GW-2 (limited action) is expected to be completed in 15 months. These implementation times do not include groundwater monitoring, which is discussed below.

**Operation and maintenance** activities for recommended remedial alternatives for soil include inspection and maintenance of asphalt caps, and long-term groundwater monitoring. Operation and maintenance activities for recommended remedial alternatives for groundwater include inspection and maintenance of groundwater monitoring wells and remediation systems, and long-term groundwater monitoring. Specific operation and maintenance requirements, which are outlined in this document, are assumed to be necessary over a 30 year time period.

Pursuant to Section 25356.1(d) of the Health and Safety Code, which requires a non-binding preliminary allocation of financial responsibility for the site clean-up, UPRR has been identified as having 100 percent financial responsibility for implementation, operation and maintenance of all recommended remedial alternatives for this site.

DRAFT
REMEDIAL ACTION PLAN
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

# 1.0 INTRODUCTION

This report constitutes a Draft **Remedial Action Plan**[2] for the Union Pacific Railroad Company's (UPRR) Railroad Yard site located in Sacramento, California. It was prepared by Dames & Moore on behalf of UPRR, pursuant to Enforceable Agreement No. HSA 86/87-015EA, issued by the California Environmental Protection Agency Department of Toxic Substances Control (DTSC) on March 26, 1987. A Remedial Action Plan is required as a part of the **remediation** process for state-listed hazardous substance release sites. The preparation of this Remedial Action Plan follows preparation of a **Remedial Investigation/Feasibility Study** Report for the UPRR Yard Sacramento site. This report was accepted as final by the DTSC in May 1991. Subsequent site investigations resulted in the preparation of an Addendum Remedial Investigation/Feasibility Study Report which was submitted to the DTSC in November 1991.

## 1.1 PURPOSE OF REMEDIAL ACTION PLAN

The purpose of a Remedial Action Plan is to provide a conceptual **clean-up** plan for the site. A Remedial Action Plan includes a summary of the Remedial Investigation/Feasibility Study Report. A Remedial Action Plan describes the methodology which has been and/or will be used to identify and subsequently design, plan, and implement a final remedial action for state-listed hazardous substance release sites. The Remedial Action Plan approval process is the means by which the public is provided an opportunity to be involved in the decision making process for the remedial action which is chosen for each site.

Remedial Action Plans are not intended to contain specific engineering design details of the proposed clean-up option; however, they must clearly and concisely describe the selected and rejected options, so that interested members of the public, government agencies, and **Potentially Responsible Parties** can provide the DTSC with meaningful opinions and comments.

Remedial Action Plans must clearly set out specific **remedial action objectives** and time frames for completion of actions. Once the DTSC adopts a final Remedial Action Plan, a commitment is made that if the Remedial Action Plan is fully implemented, the site will be certified for removal from the state

[2] All terms shown in bold type are defined in the Glossary in Section 11.0.

list of hazardous substance release sites which require remedial action or that it will be transferred to a list of sites which require long-term **operation and maintenance.**

The Remedial Action Plan is a specific requirement of California Health and Safety Code Section 25356.1. Other state and federal statutes and regulations and guidance which may be applicable to Remedial Action Plans include:

- **California Environmental Quality Act,** Public Resources Code, 21000 et seq. and Title 14, California Code of Regulations, Division 6, 1500 et seq.;
- Title 8, 14, 22, 23 of California Code of Regulations;
- California Site Mitigation Decision Tree Manual (DHS, 1986);
- **National Oil and Hazardous Substance Pollution Contingency Plan,** 40 CFR 300.61 et seq.;
- Hazardous Substance Clean-up Bond Act of 1984;
- Hazardous Substance Account Act (Division 20, Chapter 6.8, Sections 25356.1(c) - (h), 25356.3(a), 25358.7(a)-(d) and 25356.3(c) of the California Health and Safety Code);
- **Comprehensive Environmental Response, Compensation, and Liability Act** of 1980 (CERCLA), USC Sections 9601-9657 and 40 CFR 300;
- CERCLA as amended, i.e., the Federal Superfund Amendments and Reauthorization Act (SARA) of 1986;
- **Resource Conservation and Recovery Act,** Hazardous Waste Regulations, 40 CFR 260-270, as amended;
- Clean Air Act, 42 USC 7401-7642;
- Clean Water Act, 33 USC 1251 et seq. and 40 CFR 100-140, 400-470;
- EPA Guidance for Preparation of Record of Decisions and Selection of Remedy for Superfund Sites;
- Guidance for Conducting Remedial Investigations/Feasibility Studies under CERCLA (EPA 1988); and
- Interim Final Risk Assessment Guidance for Superfund (EPA, 1989).

## 1.2 SITE IDENTIFICATION

The UPRR Yard is located in the southern part of Sacramento, California (Figure 1). Residential property borders the site to the north and east; Western Pacific Avenue borders the site to the south; Sacramento City College, light industry and residential property border the site to the west.

## 1.3 INFORMATION PRESENTED IN THE REMEDIAL ACTION PLAN

The format and contents of this Remedial Action Plan are consistent with the DTSC guidance provided in Official Policy/Procedure No. 87-2 dated October 5, 1987 titled "Remedial Action Plan Development and Approval Process." A copy of Official Policy/Procedure No. 87-2 is provided in Appendix B. This Remedial Action Plan is organized as follows:

Section 1.0 discusses the purpose of the Remedial Action Plan and provides an introduction to the site.

Section 2.0 presents a history of site ownership and activities leading to current contaminated conditions, and provides a chronology of investigations and **interim remedial measures** conducted to date. This section also provides a physical description of the site and its environment with information on land use, **demography, biological receptors, climatology,** and **hydrogeology.**

Section 3.0 summarizes the data generated during the Remedial Investigation including an evaluation of soil conditions beneath the site, identification and evaluation of **hazardous substances** encountered, evaluation of hydrogeological conditions, and an evaluation of **contaminant mobility.**

Section 4.0 assesses current and potential risks posed by conditions at the site, including hazards to human health and the environment.

Section 5.0 discusses the effects of contamination upon present, future, and probable beneficial uses of land and water.

Section 6.0 summarizes the Feasibility Study and discusses **final candidate alternatives.** The final candidate alternatives are examined in terms of cost effectiveness, time required for implementation, effect on groundwater use, and environmental impacts. This section also identifies the alternatives recommended in the Feasibility Study for implementation and provides the rationale for the selection or rejection of each final candidate alternative considered. **Recommended remedial alternatives** are examined in terms of potential human health and environmental impacts and **compliance** with all applicable regulations.

Section 7.0 discusses the proposed remedial action implementation schedule for each recommended remedial alternative.

Section 8.0 contains a non-binding preliminary allocation of financial responsibility for remediating the site.

Section 9.0 discusses the requirements for ongoing operation and maintenance of the recommended remedial alternatives and addresses the issue of remediation of any contamination which is currently unknown, but is discovered at the site in the future.

## 2.0 SITE DESCRIPTION

This section presents a history of site ownership and activities leading to current contaminated conditions, and provides a chronology of investigations and interim remedial measures conducted to date. This section also provides a physical description of the site and its environment with information on land use, demography, biological receptors, climatology, and hydrogeology.

### 2.1 SITE HISTORY

#### 2.1.1 Site Location

The UPRR Yard is located in south Sacramento in Section 13 of Township 8 North, Range 4 East and in Section 18 of Township 8 North, Range 5 East, Mt. Diablo Base Meridian (Figure 1). The site encompasses an area of approximately 94 acres, consisting of two portions: the active portion, which makes up the west part of the site; and the inactive portion, which makes up the east part of the site (Figure 2). Residential property borders the site to the north and east; Western Pacific Avenue borders the site to the south; and Sacramento City College, commercial and residential properties border the site to the west. The main roads closest to the site include Freeport Boulevard about one-fourth mile west, 24th Street 30 yards east, Portola Way 30 yards north, and Sutterville Road 50 yards south.

#### 2.1.2 Nature of Business and Length of Operation

The railroad maintenance yard was established by Western Pacific Railroad (WPRR) in the early 1900s to maintain and rebuild steam locomotives, boilers, refurbish rail cars, and assemble trains. Activities conducted at the facility probably included sand-blasting, painting, machining, welding, dismantling, reassembly of locomotives and rail cars, and switching operations. Diesel engine repair and maintenance began in the mid-1950s. There is no information regarding the transition period from the maintenance of steam locomotives to the maintenance of diesel engines. UPRR purchased the operations in 1982. UPRR discontinued operations at the site in 1983. Remaining buildings and structures on the site were demolished by UPRR in 1985 and 1986.

#### 2.1.3 Type of Hazardous Substances

During operation of the site, a principal activity was refurbishing railroad cars and locomotives. This likely involved the use of various solvents, cleansers, and degreasers to clean and strip the cars. Prior to 1951, activities probably included the removal of asbestos insulation from boilers and pipes of steam engines before stripping and cleaning.

Records regarding purchases of chemicals were apparently burned in a 1983 fire that destroyed the old office building on the site. Based on the facilities at the site, shown in Figure 2, and interviews with UPRR employees, the following is inferred about chemical usage on-site:

- A caustic solution, trisodium phosphate (TSP; Oakite), was used to strip paint from railcars;
- Paints were used primarily in the Coach and Paint Shop;
- Lye was used in a below ground concrete vat south of the Main Shop;
- Two concrete lye pits existed in the area south of the Main Shop;
- Various waste oil sumps were used for oil/water separation. The sumps were periodically cleaned out and the separated water was discharged to a storm drain;
- Fuels and oil were stored on-site in both above ground and below ground tanks. Underground storage tanks included the subsurface gasoline and diesel tanks near the Oil House, a single 1,000 gallon tank north of the Main Shop building, and two concrete **bunker fuel** tanks;
- Oil was recycled at the Refined Oil Building;
- Asbestos was used for steam engine boiler insulation prior to 1951. It was stored in the Asbestos Storage Area;
- The rattler pit was located in the Main Shop Area and was used to shake deposits of minerals out of the steam pipes removed from locomotives; and
- If there was an **electroplating** activity at the facility, as DTSC has suggested in correspondence, it was on a very small scale. Only the Coach and Paint Shop could have had electroplating activity. No evidence of electroplating has been found.

### 2.1.4 Events Initiating Contaminant Release

Based on a review of historical records and information on past operating practices, eight areas of potential **contaminant** releases have been identified (Figure 2). These areas are closely related to past use. They include:

- Maintenance Facilities - These included the Main Shop and Transfer Table Area, the Coach and Paint Shop, the Car Repair Shed, and the Refined Oil Building. The primary chemicals used in these areas include waste oil, degreasing solvents, paints, and metals.
- Fuel Oil Handling Facilities - Fuel oils were used at the Fueling Area and Boiler House, and were stored at the Oil House.

- Underground storage tanks - The following underground fuel tanks were identified:

  1) 72,000 gallon concrete bunker fuel tank located west of the Main Shop.

  2) 18,000 gallon concrete bunker fuel tank located northwest of the Main Shop.

  3) Five former underground storage tanks located north of the Oil House (removed in 1986).

  4) 1,000 gallon underground storage tank partially filled with a mixture of fuel oil and **Stoddard solvent.** This tank was located on the north side of the former Main Shop building.

- Existing and Previous Track Locations - These are frequently the location of slag which contains arsenic, copper, lead, and zinc.

- Railroad Tie and Power Pole Storage Areas - Creosote-treated wood stored in this area is a potential source of hydrocarbon and metals.

- Former Pond - An impoundment located in the middle of the property, contents of which are unknown.

- Central Fill Area - An area of fill material located in the middle of the inactive portion of the site.

- Asbestos Storage Area - An asbestos storage area was located in the southwest corner of the site.

With the exception of the former pond, Central Fill Area and slag areas noted above, most of the areas of potential chemical releases appear to be located in the southern part of the inactive portion of the site. A review of site history indicates previous activities involving chemicals were not conducted in the undeveloped northern area.

#### 2.1.5 Chronology of Historical Events

A chronology of key historical events at the UPRR Yard site is summarized below:

- From the late 1800s to early 1900s the area presently occupied by the UPRR Yard consisted of ranches, farms, and orchards;

- In the early 1900s the UPRR Yard was first established by Western Pacific Railroad, for maintenance of steam locomotives and rail cars.

- In the mid-1950s a transition from repair and maintenance of steam locomotives to diesel engines began. No information regarding the transition is available, however inferred in the change of operations is a significant decrease in the use of asbestos, since most of its use was associated with steam engines; and an increase in the use of degreasers and diesel fuel.

- In 1982, UPRR purchased the site from WPRR.

- In 1983, UPRR discontinued operations at the Sacramento Yard, consolidating maintenance activities in Stockton.

- In 1985 and 1986, UPRR demolished buildings and structures on the site.

- In 1987, investigations were initiated by Dames & Moore in response to an Enforceable Agreement dated March 26, 1987, executed between UPRR and DTSC.

- In 1988, Phase I Remedial Investigation activities were conducted by Dames & Moore. Results were presented in a Phase I Remedial Investigation Report which was submitted to DTSC in 1988.

- In 1989, Phase II Remedial Investigations were conducted by Dames & Moore.

- In August 1990, Dames and Moore conducted Supplementary Groundwater Investigations to better define the extent of off-site groundwater contamination.

- On August 31, 1990 a draft Remedial Investigation/Feasibility Study Report was submitted to the DTSC.

- In May, 1991, Off-site Monitoring Well Installations and Additional On-site Soil and Groundwater Investigations were initiated. On May 28, 1991, the final Remedial Investigation/Feasibility Study was submitted to DTSC. In November 1991, an Addendum Remedial Investigation/Feasibility Report was submitted to DTSC.

### 2.1.6 Previous Studies

Investigations of the nature and extent of contamination at the Union Pacific Sacramento Railroad Yard were initiated in 1986. The final Remedial Investigation/Feasibility Study Report was completed in May 1991. Additional investigations were conducted to further assess impact to soils and groundwater, and were presented in an Addendum Remedial Investigation/Feasibility Study Report completed in November 1991. The findings of completed investigations are documented in the following reports which were prepared for UPRR and submitted to the DTSC:

1. Draft Remedial Investigation Report for Union Pacific Railroad Sacramento Shops Area, Sacramento, California, June 1988.

2. Draft Remedial Investigation Report, Union Pacific Railroad Yard, Sacramento, California, February 1990.

3. Draft Soils Feasibility Study, Union Pacific Railroad Sacramento, Sacramento, California, May 1990.

4. Hydropunch and Groundwater Investigation Report, Union Pacific Railroad Yard, Sacramento, California, July 1990.

5. Draft Remedial Investigation/Feasibility Study Report, Union Pacific Railroad Yard, Sacramento, California, August 1990.

6. Supplementary Groundwater Investigation Report, Union Pacific Railroad Yard, Sacramento, California, February 1991.

7. Final Remedial Investigation/Feasibility Study Report, Union Pacific Railroad Yard, Sacramento, California, May 1991.

8. Addendum Remedial Investigation/Feasibility Study Report, Union Pacific Railroad Yard, Sacramento, California, November 1991.

#### 2.1.7 Interim Remedial Measures

Several interim remedial measures were carried out during the course of the contaminant investigation and characterization activities at the site. The location of these activities is shown on Figure 3, described in Table 1, and summarized below.

- Construction of a fence separating the active and inactive portions of the site. The fence was installed in March 1987;

- Removal and off-site disposal of approximately 1,550 cubic yards of wood debris and asbestos in soil from August 28 through September 4, 1987. Removal and off-site disposal of an additional 50 cubic yards of soil on April 12 and 21, 1988;

- Removal and off-site disposal of the fluid contents and rinsate from the concrete 18,000 gallon underground storage tank on December 2 and 3, 1987. Removal and off-site disposal of the fluid contents and rinsate from the steel 1,000 gallon underground storage tank on August 8, 1989;

- Removal of an 18,000 gallon underground storage tank from January 18 through 25, 1988. Removal of a 1,000 gallon underground storage tank on September 15, 1989; and

- Removal of soil and **petroleum hydrocarbons** contained within a 72,000 gallon underground storage tank from March 8 through 17, 1988. Prior to tank cleaning, additional materials were removed from September 15 through 21, 1989. Tank cleaning was performed on September 27 and 28, 1989.

## 2.2 PHYSICAL DESCRIPTION

### 2.2.1 Topography

With the exception of a northwest-southeast trending berm that runs across the northern inactive portion of the site, and the north-south trending berm bordering the western site boundary (Figure 2), elevational changes across the site are generally low. Land use has modified topography over the span of railroad yard operations. The differences in elevation between the northern inactive portion of the site and the central inactive portion of the site are believed to have resulted from fill practices in the central inactive portion of the site which built this area up and made it higher in elevation than the surrounding area. The differences in elevation between the western site boundary and off-site areas is believed to have resulted from the addition of fill to the western active portion of the site to form the existing track bed.

Surface elevations range from approximately 12 feet above **mean sea level** (MSL) in the northern portion of the site, to 32 feet above MSL in the southern portion of the site. The surface of the site slopes generally to the north.

### 2.2.2 Areal Extent of Contamination

#### 2.2.2.1 Soil Contamination

Soil investigations within the inactive portion of the site indicate that arsenic, lead, and petroleum hydrocarbon contamination exists within shallow soils distributed across the site. While there is no clear pattern regarding the distribution of metals contamination, petroleum hydrocarbons appear to be located in those areas where UPRR operations historically used, recycled and/or maintained storage of diesel fuel, motor oil, etc. Slag track **ballast** which contains arsenic and lead is also distributed along existing track in the active portion of the site and along areas in the inactive portion of the site where track was formerly located. The areal distribution of arsenic, lead, petroleum hydrocarbons, and slag is shown in Figures 4 through 6. Metal contamination is predominantly confined to the upper 1-1/2 foot of soil in both the active and inactive portion of the site. Petroleum hydrocarbon contamination is predominantly confined to the upper five feet of soil in the southern inactive portion of the site, and occurs in the upper 15 feet of soil in the Central Fill Area of the inactive portion of the site.

#### 2.2.2.2 Groundwater

Groundwater investigations to date have revealed the presence of two areas of contaminated groundwater, which are shown in Figure 7. The first area (**Plume A**, Figure 7) contains **volatile organic** compounds and extends from the Central Fill Area approximately 4,800 feet southeast to 18th Avenue. The second area (Plume B, Figure 7) extends from west of the former Main Shop approximately 1200 feet to the south, just past Sutterville Road. This second area contains lower concentrations of volatile organic compounds than the first area.

### 2.2.3 Description of Structures

#### 2.2.3.1 Former Structures

Several structure were formerly located in the inactive portion of the UPRR Yard. The former locations of these structures are shown on Figure 2. They include:

- Main Shop;
- Transfer Table;
- Lumber Shed;
- Freight Car Repair Shed;
- Store House;
- Blacksmith Shop;
- Coach and Paint Shop;
- Oil House;
- Brass House;
- Fueling Station;
- Asbestos Storage Building; and
- Office.

Some of these facilities were demolished during operation of the UPRR Yard. Remaining maintenance facilities were demolished in 1985-1986.

#### 2.2.3.2 Present Structures

The active portion of the site contains the only structure which currently exists on-site. This structure is the Yard Office, which is occupied by UPRR operations personnel who are responsible for switching track, coupling and uncoupling trains, etc.

### 2.2.4 Land Uses

Current land use of the UPRR Yard is restricted to the active portion of the site (Figure 2). Activities on this portion of the site include assembling trains, off loading selected rail cars and train passage along the main line. The Yard Office described above is located in this area. The inactive portion of the site is vacant.

Land uses adjacent to the site include single family homes, schools, light industrial, and commercial businesses. Zoning designations from the City of Sacramento Planning Division (City of Sacramento, 1991) are shown on Figure 8. Land uses in the site vicinity are shown in Figure 9.

Immediately to the east, northwest, west, and north of the site are several single family residences. Located beyond these residences to the east, at a distance of approximately one-half mile from the site, are the Franklin Avenue commercial district and State Highway 99. Located beyond residences to the north, at a distance of approximately one mile from the site, is State Business 80. Immediately to the northwest of the site is a variety of single-family residences, commercial buildings including fast-food restaurants, dry cleaners, an appliance store, and a natural food store. Located beyond the single-family residences approximately 1/8 of a mile from the site is McClatchy High School. Immediately to the west of the site, U.S. Cold Storage maintains a large cold storage warehouse facility. Located beyond the U.S. Cold Storage facility are single-family residences. Immediately to the southwest of the site is Hughes Stadium and the campus of Sacramento City College. Located beyond Sacramento City College approximately 1/3 miles from the site is William Land Park. Immediately south of the site is a complex of light industrial buildings. Located beyond this complex to the south at a distance of approximately 1/8 of a mile from the site are single-family residences. Located to the southeast of the site approximately 1/8 of a mile from the site is the Sacramento Children's Home. Located beyond the Children's Home, at a distance of 1/4 mile from the site are single-family residences.

### 2.2.5 Demography

The UPRR Yard is located in the southern part of the City of Sacramento, California. The United States Department of Commerce Bureau of Census 1990 census identifies ten census tracts within approximately one mile of the site (Department of Commerce, 1990). For these tracts, 1990 census figures identify 32,100 people living in 14,335 households. Ethnic background is mixed, with 51 percent Caucasian, 21 percent Hispanic, 11 percent African-American, 1 percent American Indian or Eskimo, and 16 percent Asian. Statistics for economic background within these tracts are not yet available for the 1990 census.

### 2.2.6 Biological Receptors

The UPRR site is located in a highly urbanized area. Opportunities for animals to forage or inhabit the site are limited, since the site is mostly devoid of vegetation. Some grasses occupy a strip along the eastern and northern edges of the property which may provide **habitat** for rodents, but this area is relatively limited. According to the California Department of Fish and Game's **Natural Diversity Data Base** (NDDB) for the Sacramento East and Sacramento West Quadrangles, no sensitive species have been noted in the immediate vicinity of the site (California Department of Fish and Game, 1991). Most of the species noted from the NDDB were sighted along the riparian corridors of the American or Sacramento Rivers, which are at least 1 mile away.

### 2.2.7 Climatology

The Sacramento climate is characterized by warm summers and mild winters. The mean annual precipitation for Sacramento is 16.9 inches with nearly 90 percent of the precipitation occurring between November and April (NOAA, 1986). The mean annual temperature is 60°F with a mean range of between 45°F in January and 75°F in July (NOAA, 1986). The prevailing wind direction is from the southwest. The annual average wind speed is 8 mph. Climatology data was obtained from several downtown Sacramento weather recording stations and Executive Airport weather station approximately two miles south of the site.

### 2.2.8 Hydrogeology, Groundwater Occurrence and Water Wells

#### 2.2.8.1 Hydrogeologic Setting

The Union Pacific Railroad Yard, Sacramento, is located in the southern portion of the Sacramento Valley groundwater **basin,** approximately one mile to the east of the Sacramento River. The site geology consists of **sediments** which are characteristic of **flood plain deposits** laid down by continually shifting streams. The soils consist of a mixture of clays, silts and sands, although the upper two feet of the site contains native and non-native fill, including man-made debris. A 10 to 40 foot thick layer of clay and silty clay first encountered at a depth of 50 to 60 feet below the surface of the site forms the bottom of the first water bearing zone. Water in this zone extends upward through sands, silts and clays to a depth of 25 to 35 feet below the surface of the site.

#### 2.2.8.2 Groundwater Occurrence

Groundwater beneath the site is first encountered at a depth of approximately 21 to 35 feet below the surface of the site (Dames & Moore, 1991c). Site topography causes part of this variation. In general, groundwater beneath the site ranges from 2 feet below mean sea level at the northeast corner of the site to 8 feet below mean sea level at the southeast corner of the site. Groundwater flows to the southeast. The depth to groundwater has dropped approximately 2.5 feet since 1988.

#### 2.2.8.3 Water Wells

Based on a review of records at the Department of Water Resources, a total of seven off-site water wells are present within a one mile radius of the site (Figure 10 and Table 2). These wells are currently used for irrigation purposes only. Based on available well logs, the depth of these wells ranges from about 200 to 300 feet (Malmy, 1989). They typically pump water from approximately 100 to 300 feet below ground surface. The nearest City of Sacramento public drinking water supply well **downgradient** of the site is located on Mace Road, approximately five miles south of the site (Malmy, 1990). The Fruitridge Vista Water Company operates several drinking water wells approximately two miles downgradient of the site, south of Fruitridge Road and generally east of Highway 99 (Stockton, 1990).

# 3.0 SUMMARY OF REMEDIAL INVESTIGATION FINDINGS

This section summarizes data generated during the Remedial Investigation, including an evaluation of soil conditions beneath the site, identification and evaluation of hazardous substances encountered, evaluation of hydrogeological conditions, and evaluation of contaminant mobility.

## 3.1 GEOLOGICAL INVESTIGATIONS

Geological conditions have been investigated by excavating pits with a backhoe and drilling into the subsurface with a drilling rig. Soil samples were collected from over 420 locations across the site and evaluated for physical and chemical properties. Soil samples were collected at one or more depth intervals at each location. Over 650 soil samples were analyzed for metals, 345 soil samples were analyzed for organic compounds, and 186 soil samples were analyzed for asbestos.

### 3.1.1 Surface Soil Conditions

The Soil Survey of Sacramento County, California (Soil Conservation Services (SCS), 1991) has mapped three different types of soil units underlying the site. All three soils were developed from sediments deposited by rivers. The following descriptions of the SCS mapped soil units on-site is included to describe the native soils which are still intact under most areas of the site.

The surface soil in the southern half and northwestern part of the inactive portion of the site is a strong brown silt loam (clayey silt). The subsoil is a **claypan** comprised of yellowish red clay loam (silty clay). Underlying this is a **hardpan,** a soil horizon cemented naturally during soil development. Beneath the hardpan is a light yellowish brown loam (silty clay or clayey silt). Water may become perched above the claypan subsoil following heavy rains in winter and early spring.

The surface soil in the north central part of the inactive portion of the site is a brown and light brown silt loam (clayey silt). The subsoil is a claypan comprised of brown and strong brown clay (clay). Underlying the claypan is brown sandy clay loam (sandy clay) and sandy loam (sandy silt). Water may remain perched above the claypan of this soil for short periods after heavy rains.

The surface soil in the northeastern part of the inactive portion of the site is a pale brown silt loam (clayey silt). This is underlain by a pale brown silty clay loam (silty clay). Beneath this is a buried surface soil of gray clay (clay). The next layer is gray and pale brown clay loam. Seasonally high **water tables** may occur in this soil where not artificially drained. The absence of a claypan or hardpan makes this soil the least developed of the three soil types on site.

Surface soil investigations and interpretation of historical aerial photos and maps reveal that extensive soil cutting and filling operations have occurred in the inactive portion of the site. These operations have resulted in the deposition of fill containing natural and man-made materials. Fill occurs from ground surface to an average depth of 1.5 to 2.0 feet over most of the southern half of the inactive portion of the site. In the northern half of the site, fill occurs from ground surface to a depth of 8 to 12 feet below ground surface. The deepest zones of fill appear to be in the mid-northern and northwestern part of the inactive portion of the site.

Fill consists of silty clay, silty sands and/or gravels, demolition debris and other materials including wood, concrete, rubble, drywall fragments, coal and cinders, iron and iron slag, and other metal debris. Fill soils on the site are generally well compacted, except for the northwestern portion of the site where loose gravels and railroad track ballast predominate in the fill. The site is generally graded smooth except in the southern part of the inactive portion of the site where many depressions have resulted from demolition activities.

### 3.1.2 Subsurface Soil Conditions

Subsurface soils at the site consist of an approximately 150-foot thick assemblage of clays, silts, and sands characteristic of **flood-plain deposits** laid down by a continually shifting stream. The typical subsurface soil profile beneath the site can be summarized as:

| Typical Depth (ft) | Material |
|---|---|
| 0-2 | Fill; mainly derived from native soils at the site (see Section 3.1.1), also contains man-made materials. |
| 2-25 | Silty clay and clayey silt; contains a hardpan layer near the surface over much of the site. |
| 25-35 | Sands, silts and clays; interbedded fine-grained materials, fining upwards. The water table can extend into this material. |
| 35-50 | Sand, fine- to medium-grained; maximum thickness 25 feet, thinning to 4 feet in the southwestern corner of the site. The base of the sand is the base of the shallow **water-bearing zone.** |
| 50-60 | Clay and silty clay which form the bottom of the water-bearing zone. This layer varies in thickness from 10 feet to 40 feet, becomes siltier with depth. |
| 60-150 | Interbedded sands, silts and clays including lower water-bearing zone. |

3.1.3 Off-Site Soil Sampling

Off-site soil sampling was conducted in the vicinity of the UPRR Sacramento Yard. The purpose of the sampling was to evaluate background metals concentrations in soils, and to evaluate the impact which metals from the site may have had on adjacent property.

Nine samples were collected from Curtis Park and William Land Park with the purpose of evaluating natural background levels of arsenic, copper and lead occurring in soils around the site. The results are shown in Table 3.

A total of 94 samples were collected from three residential lots and four vacant lots adjacent to the west side of the site, and from three residential lots adjacent to the east side of the site (Figure 11). These samples were collected and analyzed for the purpose of evaluating the potential impact which arsenic, copper and lead, from the site may have had on adjacent residential lots.

3.1.4 Contamination Assessment

3.1.4.1 Nature and Extent

Results from extensive soil sampling conducted during the Remedial Investigation indicate that the soils in the inactive portion of the site contain metals (primarily arsenic and lead), organic compounds, and asbestos. Very little data is available on the active portion of the site, as investigations have concentrated on the inactive portion of the site where the majority of the former maintenance yard activities were conducted. The distribution of each type of soil contaminant at the site is discussed below.

Metals

Based on the analysis of soil samples collected during Phase 1 and Phase 2 of the Remedial Investigation, and additional soil investigations in the inactive portion of the site, several areas were found to contain elevated levels of arsenic and lead. These areas are shown in Figure 5. Elevated levels of arsenic and lead occur predominantly in the upper 1-1/2 foot of soil. Elevated levels of arsenic and lead have also been detected in some of the railroad track ballast (gravel bed for railroad ties), which contains slag. The distribution of slag is shown in Figure 6.

Based on the analysis of soil samples collected from the adjacent residential and vacant lots, one area to the west of the site was found to contain elevated levels of arsenic and lead. This area consists of Lot 1 and 2206 - 6th Avenue (Figure 11). Elevated levels of arsenic and lead occur primarily in the upper 1/2 foot of soil in Lot 1 and across a portion of 2206 - 6th Avenue.

Organic Contaminants

Organic contaminants were detected in soils in the inactive portion of the site. These contaminants consist of petroleum hydrocarbons, volatile organic compounds, and **polycyclic aromatic hydrocarbons.** Volatile organic compounds and polycyclic aromatic hydrocarbons were generally found in the same areas as petroleum hydrocarbons. A map depicting the area of soil impacted by petroleum hydrocarbons is presented as Figure 4.

Asbestos

Asbestos-impacted soils in the southern corner of the inactive portions of the site appear to be generally isolated, being found only in the vicinity of the former Asbestos Storage Building. The results of investigations conducted in this area indicate that there is approximately 1,500 cubic yards of soil which contains asbestos at concentrations of between one and five percent. The asbestos is distributed unevenly in shallow soils and extends from ground surface to a depth of approximately 2 feet. Asbestos in building materials, pipe insulation, and lagging material has also been found in this area.

3.1.4.2 Contaminant Mobility

Both organic and inorganic contaminants of concern are contained in soils at the site. The organic contaminants have been identified as petroleum hydrocarbons, primarily diesel fuel. The inorganic contaminants include lead and arsenic.

The potential for migration of petroleum hydrocarbons from soil to groundwater was addressed through a Leachability Study (Dames & Moore, 1991d) which used mathematical equations to calculate the rate at which a selected petroleum hydrocarbon constituent (naphthalene) could migrate to the groundwater. The study included several conservative assumptions.

The results of this study showed that, depending on the depth and concentration of petroleum hydrocarbon, it may constitute a potential threat to groundwater. Petroleum hydrocarbons at soil depths close to the water table represent a threat to groundwater when present at concentrations of **4000 parts per million.** However, for petroleum hydrocarbons closer to the surface, the concentrations which represent a threat to groundwater may be higher than 4000 parts per million. This is due to the fact that organic contaminants are known to break down into non-harmful carbon dioxide and water in soils when given enough time. As distances from the groundwater increase, the time during which break-down may occur also increases. This combination of factors means that petroleum hydrocarbons could break down to non-harmful chemicals if ample time and distances from the water table exist.

As mentioned above, the primary inorganic constituents of concern identified in soil are lead and arsenic. Lead typically occurs in a form which is absorbed to soils and is, therefore, generally not mobile. Arsenic can occur in soil in mobile forms; however, it is unlikely that the arsenic at the site is highly mobile because the level of arsenic in groundwater has not been measured above naturally occurring levels. Although nickel has not been identified as a problem in soils, it has been found in groundwater and may have migrated from or through soils to reach groundwater. Due to the lack of leaching studies on contaminated soils at the site, the probability that metals are being leached to groundwater is not clearly understood. Further study of the physical and chemical properties of the soil would help to better address this issue.

## 3.2 HYDROGEOLOGICAL INVESTIGATIONS

Hydrogeological conditions have been investigated by the installation of 35 on-site and three off-site groundwater monitoring wells. To evaluate the groundwater flow direction, the depth to the water table was measured in the groundwater monitoring wells approximately once every three months since 1988. Groundwater samples have been collected from both permanent groundwater monitoring wells, and temporary groundwater monitoring points. These groundwater samples were collected at a total of 56 on-site and 68 off-site locations. Since 1988, a total of 345 groundwater samples have been analyzed for volatile organic compounds, and 180 groundwater samples have been analyzed for metals.

### 3.2.1 Groundwater Conditions

#### 3.2.1.1 Physical Characteristics

Groundwater beneath the site occurs at a depth of 21 to 35 feet below ground surface, which corresponds to an elevation of 2 to 8 feet below mean sea level. The groundwater **gradient** is approximately 0.002 to 0.003. Groundwater flows to the southeast.

#### 3.2.1.2 Water Quality

In the site vicinity, groundwater is reported to be greater than 250 parts per million in **total dissolved solids**, which is a moderate level (USGS, 1985). Groundwater is reportedly moderately hard, low in chloride, sodium, manganese, and sulfate (Table 4). Nearby wells located in William Land Park were originally used for public water supply until iron and coliform were detected above drinking water standards. At this time, use of water from these wells is limited to irrigation.

#### 3.2.1.3 Beneficial Uses

Groundwater in the Sacramento Valley groundwater basin is used for municipal and domestic supply, agricultural supply, and industrial process and service supply (RWQCB, 1991). Current estimates indicate that nearly one-half of the total water supply for Sacramento County comes from groundwater (USGS, 1985). Groundwater accounts for 15 percent of the public drinking water supply in the City of Sacramento (Malmy, 1989).

### 3.2.2 Surface Water Conditions

#### 3.2.2.1 Physical Characteristics

There are no bodies of surface water on the site. The only surface water bodies present in the vicinity of the Union Pacific Railroad Yard site are the Sacramento River approximately 1 mile to the west and the American River approximately 3 miles to the north.

#### 3.2.2.2 Water Quality

Water quality in the American and Sacramento River is tested by the City of Sacramento periodically prior to treatment. The quality of surface water from the Sacramento River is said to be good 11 months out of the year (Meyer, 1991). Copper and iron levels are sometimes slightly elevated, but not above levels of concern. In the spring for one month water quality is impacted by low levels of herbicides from farms upstream of Sacramento. American River water quality is also said to be of better quality than Sacramento River water (Meyer, 1991).

#### 3.2.2.3 Beneficial Uses

Beneficial uses listed for the segment of the American River in the vicinity of the site include municipal and domestic supply, irrigation, industrial service supply, industrial power, contact and noncontact recreation, freshwater habitat/migration/spawning for warm- and cold-water fish and wildlife habitat (Table 4; RWQCB, 1991). Beneficial uses listed for the segment of the Sacramento River in the vicinity of the site include municipal and domestic supply, irrigation, contact and noncontact recreation, freshwater habitat/migration/spawning for warm- and cold-water fish, wildlife habitat and navigation (RWQCB, 1991). Treated surface water from both the American River and the Sacramento River account for 85 percent of the public drinking water supply in the City of Sacramento (Malmy, 1989).

### 3.2.3 Contamination Assessment

#### 3.2.3.1 Nature and Extent

Analytical results from extensive sampling conducted during the Remedial Investigation indicate that groundwater beneath the southern two-thirds of the site and to the southeast of the site has been impacted by volatile organic compounds, and, to a lesser extent, by nickel.

To date, groundwater investigations have evaluated the apparent lateral extent of volatile organic compounds in the shallow water-bearing zone beneath the site. These investigations have found that impacted groundwater in the shallow water-bearing zone occurs in two different areas (Figure 7):

One of these areas (Plume A, Figure 7) extends from the Central Fill Area, approximately 4,800 feet to the southeast and ranges in width between approximately 250 and 500 feet. The source of the volatile organic compounds impacting groundwater in this area appears to be located in the Central Fill Area. Two potential sources have been identified. An aerial photograph taken in 1953 indicates the presence of a former pond near the northern part of the Central Fill Area. Furthermore, excavations conducted in the Central Fill Area have revealed the presence of buried debris, including drums. To date, the source of volatile organic compounds in groundwater has not been fully resolved.

The second area (Plume B, Figure 7) extends from west of the former Main Shop area, approximately 1,200 feet to the southeast across Sutterville Avenue. The concentration of some contaminants in some samples collected in this area were slightly above the acceptable levels for drinking water. Elevated levels of nickel have also been detected within the on-site portion of this area.

#### 3.2.3.2 Contaminant Mobility

Volatile organic compounds that originally impacted only on-site groundwater, have moved approximately 4,800 feet to the southeast of the suspected on-site source and beneath an off-site area. Preliminary groundwater modeling was completed early in the groundwater investigation. The model was run for both a 10 year and 30 year elapsed period. After further groundwater investigations were completed, it was found that the extent of volatile organic compound contamination approximates the extent of the plume modeled using a 30-year release scenario. These preliminary results suggest that volatile organic compounds were released to groundwater approximately 30 years ago. Future testing and groundwater modeling will provide a better understanding of contaminant mobility.

Volatile organic compounds degrade naturally in groundwater over time. Additionally, volatile organic compounds become diluted in groundwater. The overall effect of degradation and dilution of volatile organic compounds in groundwater will be to lower concentrations over time. Dissolved metals in groundwater are often adsorbed to soil, thereby reducing their concentrations in groundwater.

## 3.3 AIR INVESTIGATION

### 3.3.1 Investigation of Air Quality

The air sampling which was conducted as part of the Remedial Investigation consisted of operation of a meteorological monitoring program which included the collection of the following data: wind speed and direction; asbestos, arsenic, copper, and lead sampling; and dust. Air samples for arsenic, cooper, lead and dust were collected over an eleven-day period. Air samples for asbestos were collected for 12 hours per day over a five-day period.

No detectable levels of copper or lead were found. Arsenic was detected in three of 12 samples analyzed. The testing methods initially used are known to produce false detections due to interference from other elements. For this reason samples were reanalyzed for arsenic using interference free testing methods. This analysis detected no arsenic in the samples. Of 30 samples collected and analyzed for asbestos, asbestos was detected in one sample. The concentration of asbestos in this sample is considered typical for urban air conditions.

Based on the sampling and analysis for dust, asbestos, arsenic, copper, and lead, there is no demonstrated impairment to air in the vicinity of the site from these constituents.

### 3.3.2 Investigation of Soil Vapors

#### 3.3.2.1 Nature and Extent

A **soil vapor study** was conducted in the former Oil House Area and Central Fill Area of the inactive portion of the site. Soil vapors were extracted from between three and 10 feet below ground surface. Samples were analyzed for selected volatile organic compounds.

In the former Oil House Area, eight samples were collected from six locations. At two locations, two samples were collected from different depths. Volatile organic compounds were detected in four of eight samples. Concentrations were relatively low.

In the Central Fill Area 26 samples were collected from 19 locations. Samples were collected at two depths from seven of the locations. Volatile organic compounds were detected 19 of 26 samples collected. Concentrations were relatively low.

#### 3.3.2.2 Contaminant Transport

The release of volatile organic compounds into air could occur at the site. The detection of volatile organic compounds in soil gas at relatively low concentrations suggests that these emissions would be minimal. The lack of detectable levels of volatile organic compounds in soil samples suggest that these contaminants have already either volatilized and been released to the atmosphere, or have migrated to groundwater over time.

It is also possible that contaminated dust from the site could become suspended in air. The potential for dust to become suspended depends upon particle size distribution, the extent of crust or aggregate formation in surface soils and the extent of vegetation or non-erodible elements (such as rocks or concrete foundations) in the soil. Vegetation on the site is sparse. However, the ground surface contains numerous non-erodible elements, including paving, debris and ballast. The magnitude of the contamination on dust particles depends on the concentrations in the surface area, which is the source of the dust. Arsenic and lead are widespread in the surface soils and have the greatest potential for emissions to the air with resuspended dust. These constituents have not been detected in sampling of dust on-site; however, future construction activities may increase the potential for suspension of contaminated dust.

## 3.4 BIOLOGICAL INVESTIGATION

An investigation of biological receptors at and in the vicinity of the site was conducted using information gathered from the NDDB (California Department of Fish and Game, 1991). General observations of the site were made during a site visit, but no detailed field studies were undertaken.

The NDDB is a computerized inventory of species of special concern that contains information on more than 1,200 species in over 18,000 locations across the state. The NDDB is maintained by the California Department of Fish and Game and The Nature Conservancy.

### 3.4.1 Description of Habitats

The site is located in a predominately urban area (see Section 2.2.4) and as a result, potential habitats for wildlife are limited. Most of the site is devoid of vegetation due to paving, railroad track ballast, gravel, debris, and land disturbances such as extensive grading. **Flora** (plant life) is limited to some exotic **forbes** (herbs other than grasses) and grasses along the eastern and northern boundaries and in the northeast quarter of the site. Vegetation includes mixed grasses, upland sedge, and a variety of **weedy species**, such as wild oat, rye-grass, bermuda grass, dock, Russian thistle, and dandelion. A few scattered shrubs are present, as well as one large cycad, a Valley Oak, and a cottonwood located near the northern boundary of the site. No rare or endangered plant species were observed (Dames & Moore, 1991b).

No mammals or reptiles were observed on the site, although the site could potentially support rodents or other small mammals along the eastern boundary (the location of the above described vegetation). Bird species observed included a variety of common songbirds: sparrows, blackbirds, and starlings. Crows and a kestrel hawk were observed during later phases of the Remedial Investigation (Dames & Moore, 1991b). Due to disturbance, sparse cover, and limited varieties of plant species, the site constitutes poor animal habitat.

The results of the NDDB survey (extending in a 5-mile radius in all directions from the site) indicate that several species of particular concern have been sighted in the general vicinity of the site. These species and the location(s) of sightings are as follows:

**Great Valley Cottonwood Riparian Forest**

- Yolo side of Sacramento River at Broderick from river mile 59.8 to river mile 62.

**Elderberry Savanna**

- California State Exposition (Cal Expo) on American River Floodplain from the Southern Pacific Railroad tracks east to just beyond Highway 80.

**Swainsons Hawk (Buteo Swainsoni)**

- Sacramento River at Chickory Bend (east side of river);
- Natomas Drainage Canal 0.5 mile north of Discovery Park, south side of the Sacramento River;
- Sacramento River, 1 mile northwest of I-80; and
- Discovery Park.

**Western Yellow Billed Cuckoo (Coccyzus Americanus Occidentalis)**

- Sacramento Bypass (none observed since 1965).

**Burrowing Owl (Athene Cunicularia)**

- Vicinity of McKinley Park, southwest of Cal Expo;
- Immediately southwest of junction of Howe Avenue and Fair Oaks Boulevard; and
- Sacramento State College and adjacent levee areas along the American River.

**Bank Swallow (Riparia Riparia)**

- South side of the American River, upstream of Cal Expo, near Business 80 bridge.

**Tricolared Blackbird** <u>(Agelaius Tricolar)</u>

- Near Port of Sacramento, just south of Highway 80, Interstate 80 junction.

**Valley Elderberry Longhorn Beetle** <u>(Desmocerus Californicus Dimorphus)</u>

- Just south of Highway 160 at Del Paso Boulevard;
- South bank of the American River, west of Hall Park (across from Cal Expo) river mile 5;
- Bushy Lake, Cal Expo;
- American River floodplain parcel between railroad track overpasses (between I-80 and Highway 160);
- Between mileage markers 6 and 7 on American River Parkway bike trail;
- Sacramento River mile 62.5 west at I-80;
- Sacramento River opposite mouth of American River, at river mile 60.3 and 59.8, west bank; and
- Sacramento River, opposite junction with Natomas, main drainage canal, river mile 61.

**Dwarf Downingia** <u>(Downingia Humilis)</u>

- Keithly Ranch, Rio Linda, north of Sacramento.

Most of these species were sighted along the riparian corridors of the American or Sacramento Rivers. Table 5 provides a summary of the distance between the site and the nearest observation of each species, and the type of cover, food, and foraging opportunities that these species require. The site itself does not provide an adequate habit at for these identified species of concern.

### 3.4.2 <u>Food Chain Analysis</u>

A **food chain** analysis was conducted because of the potential for transfer of contaminants from organisms which are lower on the food chain (i.e., insects), to those higher on the food chain (i.e., birds of prey, man). In order for this transfer to be significant, accumulation of contaminants would have to occur in organisms at a site with contaminants present. However, because of the limited quantity and poor quality of vegetation and habitat, contaminants found on the UPRR site are not likely to impact land-based animals. Exposure to contaminants is likely to be restricted to invertebrates, earthworms, insects, etc., and the plants on the site. While animals who forage on these substances may be exposed, they are likely to be exposed in a transitory manner, as the site apparently provides a scarcity of both food and cover which diminishes its ability to attract species of concern.

### 3.4.3 Contamination Assessment

Because of the absence of suitable habitat at and in the vicinity of the site, it is not likely that plants or animals will be significantly impacted by contaminants found on the site.

## 4.0 HEALTH AND SAFETY RISKS

This section assesses the potential risks to human health posed by conditions at the UPRR Yard Sacramento site. The Remedial Investigation concluded that the principal contaminants at the site were metals (i.e., lead and arsenic) and petroleum hydrocarbons in soil and volatile organic compounds (solvents such as benzene and trichloroethylene) in groundwater. The results of the Remedial Investigation were evaluated in a **Health Risk Assessment.** The Health Risk Assessment estimated the amounts of contaminants that humans could become exposed to in soil and groundwater at the site, and evaluated the potential health risks associated with exposure to these contaminants. The results of the Health Risk Assessment were used to determine the need for remedial action at the site and to select the appropriate remedial action.

The Health Risk Assessment was prepared according to guidelines provided by the U.S. Environmental Protection Agency (EPA) and the DTSC. The Health Risk Assessment was submitted to DTSC in August 1990. Comments on the Health Risk Assessment were received from DTSC in March 1991. The comments were addressed in the Revised Baseline Health Risk Assessment (Appendix J of the Addendum Remedial Investigation/Feasibility Study Report), and it has been resubmitted to the DTSC. It is currently undergoing DTSC review.

Estimates of the risks associated with contamination contain some uncertainties. To address these uncertainties, the Health Risk Assessment made several assumptions. These assumptions addressed (1) how contaminants could be transported in air or water, (2) how individuals could come into contact with contaminants at the site, and (3) what kinds of toxic effects could be expected from contaminants. The Health Risk Assessment used health-protective assumptions that tend to overstate the risks associated with contaminants detected at the site. In other words, because health-protective assumptions were used, results of the Health Risk Assessment tend to err on the side of safety.

### 4.1 RECEPTORS

A **receptor** represents an individual or individuals that could become exposed to contaminants detected at the site. The Health Risk Assessment identified receptors under current land use conditions and for future land uses. The receptors associated with current land use were: 1) **trespassers** onto the site and 2) off-site residents. Trespassers are individuals who could scale the fence, gain access to the vacant site and have direct contact with the soil. Off-site residents are assumed to be individuals who live at the boundary of the site. For the purposes of the Health Risk Assessment, the assumption was made that the off-site resident lives directly adjacent to the site at the location where the highest levels of contaminants in air, from wind-blown dust or volatile organic compounds emitted from the soil, are expected to be found. Receptors associated with future land use were: (1) off-site residents and

(2) hypothetical on-site residents. Future use of the site has not been specified. However, by assuming the presence of hypothetical on-site residents in the future, this was considered to be the most health-protective approach.

## 4.2 EXPOSURE PATHWAYS

An **exposure pathway** is the mechanism by which individuals could become exposed to contaminants detected at the site. In other words, an exposure pathway links contaminants in soil and groundwater with receptors. The potential exposure pathways associated with the trespasser scenario are ingesting contaminated soil, skin contact with contaminated soil, and inhalation of contaminated wind-blown dust or inhalation of volatile organic compounds from the soil. The potential exposure pathway associated with off-site residents (current land use) is inhalation of contaminated wind-blown dust and inhalation of volatile organic compounds from the soil. The potential exposure pathway associated with off-site residents (future land use) are inhalation of volatile organic compounds from the soil, and drinking contaminated groundwater from wells located off-site. It is assumed that future development of the site will prevent wind-blown dust by covering much of the site with buildings, landscaping and roads. The potential exposure pathway associated with on-site residents (future land use) are inhalation of volatile organic compounds from soil, swallowing contaminated soil, skin contact with contaminated soil, and drinking contaminated groundwater from wells located on-site.

## 4.3 RISK CHARACTERIZATION

**Risk characterization** provides numerical estimates of the existence and magnitude of potential human health concerns related to contamination detected at the site. Health risks associated with most of the contaminants at the site are characterized in two different ways: 1) calculation of the estimated lifetime cancer risk associated with the cancer-causing (or carcinogenic) contaminants, and 2) calculation of a **Hazard Index** for non-cancer causing (or noncarcinogenic) contaminants. The Hazard Index is a comparison of estimated exposures to noncarcinogenic contaminants with exposure guidelines. These exposure guidelines vary for each contaminant. A Hazard Index smaller than one indicates there is very little chance of adverse health effects. A summary of the risk characterization is provided in Table 6.

It should be noted that a Hazard Index is not utilized to calculate health effects from exposure to lead. Instead, mathematical models are used to predict blood lead levels based on exposure to averaged concentrations measured at the site.

Estimated lifetime cancer risks potentially associated with trespassers or off-site residents (current land use) range from nine-in-one hundred thousand (9 in 100,000) to two-in-ten thousand (2 in 10,000). Estimated lifetime cancer risks potentially associated with future on- or off-site residents range from eight-in-ten thousand (8 in 10,000) to seven-in-one thousand (7 in 1,000). The chemicals providing the greatest contribution to the estimated cancer risks are arsenic in soil, and 1,1-dichloroethene and benzene in groundwater. The Hazard Indices fell below one in all cases, except for some metals (antimony, arsenic, copper, thallium and zinc) and naphthalene in the on-site child resident case. When interpreting the estimated cancer risks presented in the Health Risk Assessment, it should be noted that average arsenic concentrations in soil in Sacramento in the area of the site (approximately 8 ppm) represent a lifetime cancer risk of one in one hundred thousand (1 in 100,000).

The primary concern for exposure to lead is the potential for impairment of mental development in children. A direct indication of whether there is a potential for an adverse health effect from lead can be obtained from the level of lead in blood. At this time, the Center for Disease Control (CDC) and other agencies including DTSC consider blood lead levels exceeding 10 **micrograms per deciliter** to be a level of concern. For any child living on a contaminated site who experiences direct contact with 300 parts per million or more of lead in soil, mathematical models predict that a blood lead level of 10 micrograms per deciliter could be expected. The average lead concentration in soil at the UPRR site is 477 parts per million. However, because the distribution of lead contamination at the site is uneven (i.e., "hot spots" exist), estimated blood lead levels for children of hypothetical on-site residents are usually expected to be lower than 10 micrograms per deciliter. Blood lead levels for no more than 5 percent of these children slightly exceed 10 micrograms per deciliter.

It should be noted that in urbanized areas, blood lead levels above 10 micrograms per deciliter are not uncommon. These elevated blood lead levels may be due to a number of potential sources of lead, including old lead-based paints, lead solder in plumbing, automobile exhaust, lead-glazed crockery, and folk remedies.

## 5.0 EFFECTS OF CONTAMINATION

Presented in this section is a discussion of the potential effects of contamination upon present, future, and probable beneficial uses of land and water.

### 5.1 PRESENT AND FUTURE USES OF LAND

#### 5.1.1 Present Uses

The site consists of two parts — an inactive portion and an active portion. The inactive portion is approximately 63 acres in size, is securely fenced and is not utilized for any purpose. It is unoccupied. The active portion is approximately 31 acres in size, is the location of the UPRR main active line, and several other track spurs which are used for limited rail car switching. Also present in the active portion of the site is an office which is occupied daily by UPRR Sacramento operations staff. The active portion of the site is only used for switching and for temporarily holding rail cars. It is not used for any railroad maintenance activities.

The General Plan of the City of Sacramento (1988) designates the site for transportation/utilities use. The site is currently zoned for heavy industrial use (M-2) under the City Zoning Ordinance, which is consistent with the use of the site for railroad maintenance activities. The majority of land uses surrounding the site are low-density residential (single family dwellings). However, a cold storage facility borders the site to the southwest, and one major educational institution (Sacramento City College) is adjacent to the southwest corner of the site (Figures 8 and 9). Additionally, some commercial and manufacturing facilities are present to the south along Sutterville Road, and to the west along Freeport Boulevard.

#### 5.1.2 Future Uses

There are currently no plans to change land use of the active portion of the site and there are currently no plans which have been reviewed and approved by UPRR or the City of Sacramento for future land use of the inactive portion of the site. However, the ad-hoc Union Pacific Land Use Committee (UPLUC) has been appointed by the Sacramento City Council to prepare land use recommendations for the inactive portion of the site. One potential future use of the site identified by the UPLUC is the possibility of extending light rail through the inactive portion of the site, and locating a light rail station in this area. The UPLUC is planning to provide land use recommendations to the City Council in March 1992.

### 5.1.3 Potential Effects

Existing contamination is expected to adversely affect both present and future beneficial land uses at the site. However, because existing uses of the active portion of the site are industrial and/or transportation-related, because these uses are not expected to change in the future, and because these uses are compatible with the current nature and extent of contamination, effects of contamination at the site would be most pronounced in the inactive portion which is currently vacant.

Remediation would also affect present and future beneficial land uses at the site. The effects of remediation would primarily be beneficial. However, the degree of compatibility between remediation and future land use will depend on the type and extent of this use. For example, if remediation includes installation of an asphalt cap, compatible land uses will only include activities which do not impact the integrity of the cap (i.e., vehicle parking, industrial warehouses, etc.).

Conversely, if remediation includes removal of the highest concentration of contaminants, a greater variety of land uses would probably be acceptable to DTSC. In this case, the only land use which might be considered unacceptable would be residential development.

Finally, the greatest compatibility between remediation and land use corresponds to full remediation, which includes removal of all significant soil contamination from the site. In this case, neither a cap nor long-term monitoring would be required and all future land use. including residential development,would be acceptable.

## 5.2 PRESENT AND FUTURE USES OF WATER

### 5.2.1 Surface Water

#### 5.2.1.1 Present Uses

There are no surface water resources at the site. The surface water resources in the area consist of the Sacramento River, approximately one mile to the west, and the American River, almost three miles to the north. Beneficial uses of the Sacramento River include municipal and domestic supply, irrigation, contact and noncontact recreation, freshwater habitat/migration/spawning for warm- and cold-water fish and wildlife habitat, and navigation (RWQCB, 1991). Beneficial uses of the American River include municipal and domestic supply, irrigation, industrial service supply, industrial power supply, contact and noncontact recreation, freshwater habitat/spawning/migration for warm and cold water fish, and wildlife habitat (RWQCB, 1991). Treated water from the Sacramento and American Rivers accounts for approximately 85 percent of the public domestic drinking water supply in the City of Sacramento (Malmy, 1989).

Surface flow across the site generally drains to the east along the middle part of the inactive portion of the site next to residences along 24th Street, and to the southwest towards the tracks. Drainage along the western boundary of the site is directed to street culverts. The flow from both portions of the site is subsequently directed underground combined sewer/storm drains which is routed to the Sacramento County Regional Sanitation District Plant.

5.2.1.2 Future Uses

None of the present beneficial uses for the Sacramento and American Rivers are expected to be discontinued in the future. Furthermore, the RWQCB has failed to identify any potential beneficial uses for these surface water resources other than those which are discussed above (RWQCB, 1991).

5.2.1.3 Potential Effects

Currently run-off from the site could potentially come in contact with contaminants, and contaminated run-off and sediments could be transported off-site to storm drains. Proposed remediation for site soils calls for removing or capping sources of contamination, thus preventing run-off on the site from coming into contact with contaminants.

Since there are no surface water resources at the site, and since proposed site remediation will prevent surface water run-off from coming into contact with contaminants, the present and future uses of surface water in the vicinity of the site will not be adversely affected by existing contamination or proposed remediation.

5.2.2 Groundwater

5.2.2.1 Present Uses

There are seven off-site water wells present within a one-mile radius of the site (Figure 10, Table 2). These wells are used for irrigation and are not used for drinking water supply. The nearest drinking water wells in the site area are approximately two miles to the southeast, and belong to the Fruitridge Vista Water Company (Stockton, 1990). Groundwater in the Sacramento River Basin has been and/or is used for municipal, domestic, and industrial purposes (RWQCB, 1991).

5.2.2.2 Future Uses

The groundwater within this area of the Sacramento River Basin is not specifically listed as a groundwater resource in the RWQCB Basin Plan (RWQCB, 1991). According to the Basin Plan, the potential beneficial uses for groundwater in this area include community and military water systems and domestic uses associated with individual water supply systems.

5.2.2.3 Potential Effects

Contamination has been detected in groundwater beneath the site, and presently groundwater contamination extends to the southeast approximately 4,500 feet. The results of the Health Risk Assessment (Section 4.0) indicate that the contaminated groundwater poses a health risk if ingested. However, there are no drinking water supply wells or water supply wells of any other type located within the contaminant plume. Therefore, contamination is not expected to adversely affect present beneficial uses of groundwater.

As for effects on future beneficial uses of groundwater, groundwater contamination from the site, if not addressed, could potentially impact downgradient groundwater users. Contamination would also adversely affect most of the potential beneficial uses listed above (i.e., municipal, domestic, industrial, or military), if supply wells are installed within the contaminant plume in the future. The exception to this might be any wells which are installed for the purpose of supplying industrial or military activities. These uses typically have lower standards (i.e., can tolerate higher contaminant concentrations).

As for groundwater remediation, extracting groundwater will result in a decline in groundwater levels by several feet in the area pumped. It will potentially alter the direction and velocity of groundwater flow. It may also result in small-scale, highly localized **subsidence** (collapse) of soil in the areas surrounding the **extraction wells.** All of these activities may adversely affect both present and future beneficial uses of groundwater. However, because remediation would be conducted using off-site wells with a low pumping rate over a long period of time, or on-site wells with a high pumping rate over a short period of time, the magnitude of these effects is not expected to be significant.

## 6.0 REMEDIAL ACTION FEASIBILITY STUDY

Following completion of the Remedial Investigation, a Feasibility Study was conducted for the UPRR site. This work was supplemented by additional work which is documented in the Addendum Remedial Investigation/Feasibility Study Report (Dames & Moore, 1991d). The purpose of both the Feasibility Study and the information in the addendum are to select a recommended remedial alternative(s) for the site which will provide adequate protection of public health and the environment, comply with applicable laws and regulations, and be cost-effective.

The Addendum Remedial Investigation/Feasibility Study Report (Dames & Moore, 1991d), identifies and screens several potentially applicable remedial technologies. The technologies which survive screening are assembled into alternatives to address all areas and contaminants of concern at the site. Alternatives are screened; the ones which survived are known as final candidate alternatives. These alternatives undergo detailed analysis using nine criteria which include short- and long-term effectiveness; implementability; compliance with laws and regulations; reduction of toxicity, mobility and volume; cost-effectiveness; overall protection of human health and the environment; community acceptance; and agency acceptance. The detailed analysis of final candidate alternatives is used to identify their relative advantages and disadvantages and to select a recommended remedial alternative for each Operable Unit.

The following sections describe the final candidate alternatives for each Operable Unit, discuss their objectives and scope, cost-effectiveness, implementation time, effect on groundwater use and environmental impacts. They also provide justification for the rejection or selection of each final candidate alternative as the recommended remedial alternative for the Operable Unit for which it was developed. This is followed by a description of the design and construction of each recommended remedial alternative and a discussion of the applicable regulations with which these alternatives must comply.

### 6.1 DEFINITION OF OPERABLE UNITS

An Operable Unit is defined as any contaminated area or media of concern which, because of unique chemical and/or physical characteristics, requires special remediation techniques and/or affords the opportunity for more expeditious and/or cost-effective remedial action if addressed separately during site clean-up. In the Addendum Remedial Investigation/Feasibility Study Report (Dames & Moore, 1991d), five separate Operable Units are established for soil and two Operable Units are established for groundwater. The locations of these Operable Units are shown on Figures 12 and 13.

It is important to note that the application of final candidate alternatives to Operable Units is defined in terms of the amount and concentration of contaminants which are addressed, removed, treated, and/or disposed. For the purposes of this Remedial Action Plan, only two quantities of contaminants are addressed by the different alternatives for each Operable Unit. These are:

- Soil Above Remedial Action Objectives — **Remedial Action Objectives** are specific to either soil or groundwater. They are levels or concentrations of contaminants which are deemed to be the most protective of human health and the environment.

- Soil Above Hot-Spot Levels — **Hot Spots** are the areas of the highest concentration of contaminants of concern. These areas either present (1) a potential health risk recognized by either the DTSC or the U.S. Environmental Protection Agency, or (2) a concentration of contaminants which represent a potential source of groundwater contamination.

## 6.2 FINAL CANDIDATE REMEDIAL ALTERNATIVES

### 6.2.1 Operable Unit S-1

#### 6.2.1.1 Alternative 1: No Action

Objectives and Scope

The **National Oil and Hazardous Substances Pollution Contingency Plan** requires that the No Action Alternative be considered. The amount of risk reduction provided by each of the other final candidate alternatives is compared to the No Action Alternative to assess how effective they are. This alternative involves no remediation (clean-up) of contaminated soil; it consists primarily of constructing and maintaining a fence around the entire site to prevent unauthorized access. A **land use covenant** would be entered into by UPRR and DTSC. The land use covenant would be noticed on the deed to the property to regulate future land uses and activities on the property which might disturb soil contaminants and cause human health risks and/or adverse environmental impacts. In addition, groundwater beneath the site would be monitored for a period of thirty years to check for changes in groundwater quality caused by the migration of contaminants in soil. A report which discusses **groundwater monitoring** results would be submitted to the DTSC on a yearly basis.

Cost Effectiveness

This alternative has the lowest total **present worth** cost of all the alternatives being considered for Operable Unit S-1. The total present worth cost of this alternative is $803,000. This total includes both **capital costs** and Operation and Maintenance (O&M) costs. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years.

Capital costs (for equipment, labor, and materials) are approximately $105,000. This includes the cost of repairing and/or replacing the existing fence which surrounds the site. Operation and maintenance costs are $1,170,000. This includes the costs for groundwater monitoring and preparation of an annual report.

Implementation Time

Since this alternative does not include any remediation of contaminated soil, the time needed to put this alternative into effect (implementation time) is expected to be approximately four months. This includes time needed to prepare a groundwater monitoring work plan, construct and/or repair the existing fence, develop the land use covenant, and notice the requirements on the property deed, and get DTSC approval for the work plan.

Groundwater Use

Of all the final candidate alternatives which were considered, this alternative presents the greatest risk to groundwater quality because none of the contaminated soil in S-1 would be removed or treated to reduce the level of contamination in this area. As a result, these contaminants could migrate to groundwater and thus pose a threat to human health and the environment. The thirty-year groundwater monitoring program would be designed to provide an early warning of any groundwater contamination which might occur after implementation of this alternative is complete.

Environmental Impact

Because this alternative does not include any remediation of contaminated soil, it does not pose a potential significant environmental impact except for those which have already occurred or might occur as the result of contaminant migration either to groundwater or off-site in the form of airborne dust. Of all the final candidate alternatives, this alternative provides the least long-term protection of the environment.

Justification for Rejection or Selection

This alternative was rejected from consideration as the recommended remedial alternative because it would not meet Remedial Action Objectives and would not provide adequate protection of human health and the environment. It would not reduce the toxicity, mobility, or volume of the contaminants at the site, nor would it eliminate the need for long-term access restrictions, deed notices or groundwater monitoring.

#### 6.2.1.2 Alternative 4: Containment with Institutional Controls

##### Objectives and Scope

If this alternative were chosen, all contaminated soil would be left in place on the site. Debris would be cleared away, the surface soils would be graded, and an asphalt cap would be constructed to cover the soils contaminated above the Remedial Action Objectives. This cap is designed to reduce movement of rainwater downward through the contaminated soil and prevent contaminated soil from being blown off-site by wind. The cap would be built so that water naturally flows away from the capped areas.

During construction (especially at those times when contaminated soil is being moved or otherwise disturbed), soil would be wetted down by a water truck equipped with a sprinkler attachment to minimize the amount of dust raised by these activities. Samples of air from the site and vicinity would be collected and analyzed during all construction activities. If analysis of air samples shows that dust from construction activities results in a significant threat to human health or the environment, construction would be stopped until dust generation can be mitigated.

The completed asphalt cap would be inspected yearly so that repairs, if necessary, could be made. Regular maintenance of the asphalt surface would include re-sealing one-fourth of the entire cap every year in rotation so that the entire cap is resealed every four years. Additionally, the cap surface would be replaced with fresh asphalt every ten years. This maintenance program is designed to keep the cap in good condition.

In addition to construction of the cap over areas where soil is contaminated above the Remedial Action Objectives, a land use covenant would be entered into by DTSC and UPRR. The land use covenant would be noticed on the deed to the property to regulate future land uses and activities on the property which might disturb soil contaminants and cause human health risks or adverse environmental impacts. The site would be fenced to restrict unauthorized access. Groundwater quality would be monitored for a period of thirty years after the cap is finished. A report which discusses the results of groundwater monitoring would be submitted to DTSC on a yearly basis.

Cost Effectiveness

This alternative has the second lowest total present worth cost of all the alternatives being considered for Operable Unit S-1. Only Alternative 1 would cost less. The total present worth cost of this alternative is approximately $4,748,000. This total includes both capital costs and Operation and Maintenance (O&M) costs. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years.

Capital costs (for equipment, labor, and materials) are approximately $3,563,000. This includes the cost of all construction activities and repairing and/or replacing the existing fence which surrounds the site. Operation and maintenance costs would be approximately $2,483,000. This includes the cost for cap maintenance and replacement, the groundwater monitoring program and yearly monitoring reports.

Implementation Time

The time needed to implement this alternative is expected to be ten months. This includes three months for engineering design of the cap, three months to obtain the necessary permits, and seven months to clear and grade the site and construct the asphalt cap and fence. It is expected that design of the cap would be conducted during the same time as permitting. Completion of the project could be delayed if either permit approval or design are delayed, or if unplanned difficulties occur during construction.

Groundwater Use

Groundwater use will not be significantly affected by this alternative. One purpose of the cap is to reduce the amount of water moving downward through contaminated soil and into groundwater. This alternative is therefore more likely to protect groundwater than Alternative 1, but less likely than Alternatives 5, 6, and 10. The thirty-year groundwater monitoring program would be designed to provide an early warning of any groundwater contamination which might occur because of the downward movement of soil contaminants.

Environmental Impact

Dust control measures would be used during site clearing, grading, and construction activities to minimize problems caused by contaminated airborne dust. Due to the nature of asphaltic material, there would likely be some odor during paving of the asphalt cap. However, the level of air emissions during cap construction is not expected to be significantly greater than that associated with normal urban activity (such as paving streets), and should not result in significant environmental impacts. There would also be some increased noise and traffic at and near the site during the hours when site work is underway. However, the impact of noise and traffic is expected to be low because site work is planned for daylight hours during the week when most people are away from their homes.

Justification for Rejection or Selection

This alternative would greatly reduce the mobility of the contaminants (the ability of the contaminants to move into the groundwater beneath the site and to move off-site in the form of airborne dust). Although it would not reduce the toxicity of the contaminants or the volume of contaminated soil, it would effectively eliminate the most significant means of human exposure to the soil contaminants and environmental impacts. Thus, it would provide adequate protection of human health and the environment. This alternative is more expensive than Alternative 1, but less expensive than Alternatives 5, 6, and 10. It would also require less time to implement and cause fewer short-term environmental impacts during implementation than those alternatives. Therefore, this alternative was selected as the recommended remedial alternative for Operable Unit S-1.

#### 6.2.1.3 Alternative 5: Excavation/On-Site Treatment of Hot Spots with Capping

Objectives and Scope

This alternative consists of excavation and on-site treatment of soils contaminated with lead and/or arsenic at or above Hot Spot levels. The soil would be treated using a technology called soil washing. After the site is cleared and existing debris disposed of off-site, contaminated soil would be excavated and brought to an on-site treatment area where it would be placed into a soil washing machine. Inside the machine, the soil would be mixed with a solution of chemicals which would remove much of the arsenic and/or lead from the soil particles. When soil washing is complete, the levels of arsenic and lead in soil would be significantly less because the contaminants would have been transferred to the washing solution. The **by-products** of soil washing are (1) a contaminated washing solution (liquor) and (2) a small amount of soil that is much more contaminated than it was before treatment. The liquor and highly contaminated soil would be taken off-site and disposed of in an appropriately licensed and permitted landfill. Treated soil would be placed back in the excavations from which it was removed.

After excavation, and before **backfilling** of treated soil occurs, soil samples would be taken from the bottom and sides of the excavation pits to verify that all Hot Spot soil has been removed and treated. The samples would be sent to a laboratory and tested for arsenic and lead. If the testing shows that there is still soil in the pits that is contaminated above Hot Spot levels, excavation would continue until test results indicate that the pits have been cleaned up to the desired level.

After the excavations have been backfilled with treated soil, an asphalt cap would be constructed over the areas where there is untreated soil which contains contamination greater than the Remedial Action Objectives. The cap would also cover the treated soil. The cap is designed to reduce movement of rainwater downward through the contaminated soil into the groundwater beneath the site and prevent contaminated soil from being blown off-site by wind.

During construction (especially at those times when contaminated soil is being moved or otherwise disturbed), soil would be wetted down by a water truck equipped with a sprinkler attachment to minimize the amount of dust raised by these activities. Samples of air from the site and vicinity would be collected and analyzed during all construction activities. If analysis of air samples shows that dust from construction activities results in a significant risk to human health or the environment, construction would be stopped until dust generation can be mitigated.

The asphalt cap would be inspected yearly so that repairs, if necessary, could be made. Regular maintenance of the asphalt surface would include re-sealing one-fourth of the entire cap every year in rotation so that the entire cap is resealed every four years. Additionally, the cap surface would be replaced with fresh asphalt every ten years. This maintenance program is designed to keep the cap in good condition.

Because this alternative would remove the major source of potential groundwater contamination from S-1 through treatment, and off-site contaminant migration would be prevented by the cap, it does not include groundwater monitoring. However, residual levels of contamination above the Remedial Action Objectives would be left in soil. Therefore, a land use covenant would be entered into by DTSC and UPRR. The land use covenant would be noticed on the deed to the property to regulate future land uses and activities on the property which might disturb soil contaminants and cause human health risks or adverse environmental impacts. The site would be fenced to restrict unauthorized access.

Cost Effectiveness

This is the second most expensive alternative being considered for Operable Unit S-1. It is less expensive than Alternative 10, but more expensive than Alternatives 1, 4, and 6. The total present worth cost of this alternative is $9,181,000. This total includes both capital costs and Operation and Maintenance (O&M) costs. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years.

Capital costs (for equipment, labor, and materials) would be approximately $8,956,000. This includes the cost of all construction activities, soil washing, and repairing and/or replacing the existing fence which surrounds the site. Operation and maintenance costs would be approximately $1,313,000. This includes costs for cap maintenance and replacement.

### Implementation Time

The time needed to implement this alternative is expected to be 18 months. This includes three months for engineering design of the cap, three to six months to obtain the necessary permits, and 12 months to clear and grade the site, excavate and treat Hot Spot soils, backfill excavations with clean imported soil, and construct the asphalt cap and fence. It is expected that design of the cap would be started at the same time as permitting. Completion of the project could be delayed if either permit approval or design are delayed, or if unplanned difficulties occur during excavation, soil washing or cap construction.

### Groundwater Use

Groundwater use will not be significantly affected by this alternative. Soil washing would significantly reduce the level of soil contamination, so that contaminants would be less likely to move downward into groundwater. In addition, one purpose of the cap is to reduce the amount of rainwater moving downward through contaminated soil and into groundwater. This alternative is therefore more likely to protect the groundwater than Alternatives 1 and 4, but less likely than Alternatives 6 and 10.

### Environmental Impact

Because of the extensive excavation and soil-handling activities associated with the soil washing procedure, dust generation is expected to be higher for this alternative than for Alternatives 1 and 4. However, dust control measures would be used during site clearing, grading, excavation, soil washing, and construction activities to reduce the creation of contaminated airborne dust. Due to the nature of asphaltic material, there would likely be some odor during paving of the asphalt cap. However, the level of air emissions caused by cap construction is not expected to be significantly greater than that associated with normal urban activity (such as paving streets), and should not result in significant environmental impacts. There would also be some increased noise and traffic at and near the site during the hours when site work is underway. However, the impact of noise and traffic is expected to be low because site work would be planned for daylight hours during the week when most people are away from their homes.

Justification for Rejection or Selection

This alternative would reduce the toxicity, mobility, and volume of soil contaminants. It would effectively eliminate the most significant means of human and environmental exposure to the soil contaminants and would thus provide adequate protection of human health and the environment.

Despite these advantages it should be noted that soil washing has not been proven for arsenic and lead. In the past it has been primarily used to remove petroleum hydrocarbons from soil. Furthermore, there are few qualified contractors who are experienced in this type of treatment and can provide sufficient equipment to complete the job in a reasonable time. For this reason, a treatability study must be performed on contaminated soil from the site to assess how successful soil washing would be and how long the treatment process would take to reduce contamination to an acceptable level. Until this is done, the implementation time for this alternative is assumed to be the greatest of all the final candidate alternatives being considered for this operable unit because soil washing can take a long time, particularly with the types of soils that are present at the site (i.e., silts and clays). This is the second most expensive of the alternatives for this operable unit; Alternative 10 is the only one that would cost more. Because of the uncertainty regarding the success of soil washing and the potential environmental impact of an extended implementation period, the potential problems associated with this alternative are greater than the potential benefits. Therefore, this alternative was rejected as the recommended remedial alternative for Operable Unit S-1.

#### 6.2.1.4 Alternative 6: Excavation/Off-Site Disposal of Hot Spots with Capping

Objectives and Scope

This alternative consists of excavation and off-site disposal of soils contaminated with lead and/or arsenic at or above Hot Spot levels. Excavated soil would be loaded onto either rail cars or trucks and taken off-site and disposed of in an appropriately licensed and permitted landfill.

In order to verify that all the Hot Spot soil has been removed, soil samples would be taken from the bottom and sides of the excavation pits. The samples would be sent to a laboratory and tested for arsenic and lead. If the testing shows that there is still soil in the pits that is contaminated above the Hot Spot levels, excavation would continue until test results indicate that the pits have been cleaned up to the desired level.

Clean soil brought from off-site would be placed in the pits created during excavation of the Hot Spot soils. An asphalt cap would then be constructed over the areas where the remaining soil contains contamination greater than the Remedial Action Objectives. The cap would also cover the backfilled pits.

This cap would be designed to reduce movement of rainwater downward through the contaminated soil toward groundwater and prevent contaminated soil from being blown off-site by wind.

During construction (especially at those times when contaminated soil is being moved or otherwise disturbed), soil would be wetted down by a water truck equipped with a sprinkler attachment to minimize the amount of dust raised by these activities. Samples of air from the site and vicinity would be collected and analyzed during all construction activities. If analysis of air samples shows that dust from construction activities results in a significant risk to human health or the environment, construction would be stopped until dust generation can be mitigated.

In addition to construction of the cap, the site would be fenced to restrict unauthorized access. The asphalt cap would be inspected yearly so that repairs, if necessary, could be made. Regular maintenance of the asphalt surface would include re-sealing one-fourth of the entire cap every year in rotation so that the entire cap is resealed every four years. Additionally, the cap surface would be replaced with fresh asphalt every ten years. This maintenance program is designed to keep the cap in good condition.

Because this alternative would remove the major source of potential groundwater contamination from S-1, it does not include groundwater monitoring. However, residual levels of contamination above the Remedial Action Objectives would be left in soil. Therefore, a land use covenant would be entered into by DTSC and UPRR. The land use covenant would be noticed on the deed to the property to regulate future land uses and activities on the property which might disturb soil contaminants and cause human health risks or adverse environmental impacts.

Cost Effectiveness

This is the third most expensive alternative being considered for Operable Unit S-1. It is less expensive than Alternatives 5 and 10, but more expensive than Alternatives 1 and 5. The total present worth cost of this alternative is $6,301,000. This total includes both capital costs and Operation and Maintenance (O&M) costs. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years.

Capital costs (for equipment, labor, and materials) would be approximately $5,932,000. This includes the cost of excavating and disposing of the Hot Spot soil, all construction activities, and repairing and/or replacing the existing fence which surrounds the site. Operation and maintenance costs would be approximately $1,313,000. This includes the costs for cap maintenance and replacement.

### Implementation Time

The time needed to implement this alternative is expected to be 10 1/2 months. This includes 3 months for engineering design of the cap, three months to obtain the necessary permits, and seven and one-half months to clear and grade the site, excavate and dispose of Hot Spot soils, backfill excavation with clean imported soil, and construct the asphalt cap and fence. It is expected that design of the cap would be conducted during the same time as permitting. Completion of the project could be delayed if either permit approval or design are delayed, or if unplanned difficulties occur during excavation or cap construction.

### Groundwater Use

Groundwater use would not be significantly affected by this alternative. Disposing of Hot Spot soil off-site would significantly reduce the mobility of contaminants so that they would be less likely to move downward into groundwater. In addition, the cap would reduce the amount of rainwater which is available to mobilize remaining contaminants and cause them to move downward into the groundwater. This alternative is therefore more likely to protect the groundwater than Alternatives 1, 4 and 5, but less likely than Alternative 10.

### Environmental Impact

Dust generation is expected to be higher for this alternative than for Alternatives 1 and 4, but less than Alternative 5 because this alternative includes less on-site handling of soil. Dust control measures would be used during site clearing, grading, excavation, and construction activities to reduce generation of contaminated airborne dust. Due to the nature of asphaltic material, there would likely be some odor during paving of the asphalt cap. However, the level of air emissions caused by cap construction is not expected to be significantly greater than that associated with normal urban activity (such as paving streets), and should not result in significant environmental impacts. There would also be some increased noise and traffic at and near the site during the hours when site work is underway. However, the impact of noise and traffic is expected to be low because site work would be planned for daylight hours during the week when most people are away from their homes.

### Justification for Rejection or Selection

This alternative would reduce both the volume and mobility of soil contaminants at the site. It would effectively eliminate the most significant means of human exposure to soil contaminants and environmental impacts, and thus provide adequate protection of human health and the environment.

The implementation time for this alternative is higher than Alternatives 1, 4 and 10, but less than Alternative 5 for this operable unit. This is the third most expensive of the alternatives for this operable unit; Alternatives 5 and 10 would cost more, and Alternatives 1 and 4 would cost less. Because the potential benefits of removing the Hot Spot soils prior to capping do not justify the significantly greater short-term environmental impacts, cost and implementation time, this alternative was rejected as the recommended remedial alternative for Operable Unit S-1.

#### 6.2.1.5 Alternative 10: Excavation/Off-Site Disposal of Soil Above Remedial Action Objectives

Objectives and Scope

This alternative consists of excavation and off-site disposal of the soil contaminated with asbestos, lead and/or arsenic at or above the Remedial Action Objectives. After the site is cleared and construction debris disposed of off-site, excavated soil would be loaded onto either rail cars or trucks and taken off-site and disposed of in an appropriately licensed and permitted landfill. Clean soil brought from off-site would be placed in the pits created during excavation.

During construction (especially at those times when contaminated soil is being moved or otherwise disturbed), soil would be wetted down by a water truck equipped with a sprinkler attachment to minimize the amount of dust raised by these activities. Samples of air from the site and vicinity would be collected and analyzed during all construction activities. If analysis of air samples shows that dust from construction activities results in a significant risk to human health or the environment, construction would be stopped until dust generation can be mitigated.

In order to verify that the soil contaminated above the Remedial Action Objectives has been removed, soil samples would be taken from the bottom and sides of the excavation pits. The samples would be sent to a laboratory and tested for arsenic, lead, and/or asbestos, as appropriate. If the testing shows that there is still soil in the pits that is contaminated above the Remedial Action Objectives, excavation would continue until test results indicate that the pits have been cleaned up to the desired level.

Because this alternative provides for the removal of the soil contaminated above the Remedial Action Objectives, a fence, deed restrictions, and groundwater monitoring are not included as part of this alternative.

## Cost Effectiveness

This is the most expensive alternative being considered for Operable Unit S-1. The total present worth cost of this alternative is approximately $19,197,000. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years. This includes capital costs for equipment, labor, and materials. It also includes the cost of excavating and disposing of the soil contaminated above the Remedial Action Objectives, and all related construction activities. There would be no operation and maintenance costs associated with this alternative.

## Implementation Time

The time needed to implement this alternative is expected to be 10 months. This includes two months for engineering design, three months to obtain the necessary permits, and seven months to clear and grade the site, excavate and dispose of the soil, and backfill the pits. It is expected that design and permitting would begin at the same time. Completion of the project could be delayed if permit approval is delayed, or if unplanned delays occur during excavation.

## Groundwater Use

Groundwater use would not be affected by this alternative. Disposing of the soil contaminated above the Remedial Action Objectives would effectively eliminate contaminants that could move downward into groundwater. This alternative is therefore likely to protect the groundwater more than any of the other final candidate alternatives.

## Environmental Impact

Dust generation is expected to be higher for this alternative than for all other alternatives because of the very large volume of soil that would need to be excavated and disposed of. Dust control measures would be used during site clearing, grading, excavation, and construction activities to reduce the generation of contaminated airborne dust. There would also be some increased noise and traffic at and near the site during the hours when site work is underway. However, the impact of noise and traffic is expected to be low because site work is planned for daylight hours during the week when most people are away from their homes.

Justification for Rejection or Selection

This alternative would reduce both the volume and mobility of soil contaminants. This alternative would effectively eliminate the most significant means of human exposure to soil contaminants and environmental exposure, and would thus provide adequate protection of human health and the environment.

The implementation time for this alternative is higher than Alternatives 1, 4 and 6, but less than Alternative 5 for this operable unit. This is the most expensive of the alternatives for this operable unit. Because the potential benefits of removing the soil contaminated above the Remedial Action Objectives do not justify the significantly greater short-term environmental impacts, cost and implementation time, this alternative was rejected as the recommended remedial alternative for Operable Unit S-1.

6.2.1.6 Recommended Remedial Alternative

The recommended remedial alternative for Operable Unit S-1 is Alternative 4. This alternative includes constructing a specially designed asphalt cap to cover soil contaminated above the Remedial Action Objectives, constructing and/or repairing a fence around the site to restrict access, repairing and replacing portions of the asphalt cap as necessary, conducting groundwater monitoring, and developing a land use covenant and placing a notice on the deed to the property to regulate future land uses and activities on the property so that the contaminants are not disturbed.

Justification for Selection

Alternative 4 was selected as the recommended remedial alternative for Operable Unit S-1 for the following reasons:

- It would effectively eliminate the primary exposure pathways (inhalation of contaminated dust and ingestion of contaminated soil);
- It would significantly reduce downward movement of rainwater through the contaminated soils, thereby providing good groundwater quality protection;
- Groundwater quality would be monitored for 30 years following construction of the cap, thereby providing an even greater degree of groundwater quality protection;
- It provides better short-term protection of human health and the environment than those alternatives which include excavation of contaminated soil;

- The technologies used (excavation, landfilling, and capping) are well-tested, proven and easy to implement;

- It provides adequate overall long-term protection of human health and the environment; and

- It is the most cost-effective of all final candidate alternatives for this Operable Unit, except for Alternative 1.

Following approval of this Remedial Action Plan, a **Remedial Design Work Plan** will be prepared. It will provide detailed design specifications for the recommended remedial alternative for this Operable Unit, a **Site Health and Safety Plan,** and an Operation and Maintenance Plan. After the Remedial Design Work Plan is prepared, it will be submitted to the DTSC for review and approval.

Design Activities

The asphalt cap will be designed to be consistent with future potential land uses. The cap is expected to be designed with a minimum one percent slope to provide natural drainage away from the cap. Drainage channels will be constructed as necessary to divert runoff into existing sanitary sewers surrounding the site. The engineering design of the asphalt cap would include several design documents and drawings which would be incorporated into the Remedial Design Work Plan. These documents may include the following:

- Grading design drawings;

- Asphalt cap design drawings;

- Cap construction specifications;

- Equipment and material lists; and

- Subcontractor bid and performance specifications.

Permits for remedial activities are likely to be required. Some of these may include an air emissions permit from the Sacramento Metropolitan Air Quality Management District and construction permits from the City of Sacramento Building Department.

## Construction Activities

Construction activities will begin only after DTSC approval is received. Site work and construction will probably take place in the following order:

- The site will be cleared and grubbed (shrubs, trees, and debris will be removed and disposed of off-site);
- The fence that currently surrounds the site will be repaired or reconstructed as necessary to prevent unauthorized access to the site during construction activities;
- Clean soil **(clean fill)** will be brought from another location, placed and graded to the appropriate surface shape so that rainwater will flow naturally off the finished cap. As the clean fill is placed in thin layers, it will be compacted using special equipment to provide a stable base for the asphalt cap;
- A layer of gravel will be placed over the soil foundation and compacted;
- Two separate layers of asphalt will be applied on top of the gravel layer. The first layer, approximately 4 inches thick, will be the base layer. The second layer, which is sometimes called a **Petromat Overlay,** is approximately two inches thick and will be separated from the base layer by a special fabric and sealant. This second layer is designed to increase the life of the base layer by protecting it from wear, sunlight, and weather. This second layer is the part of the cap that will be replaced every ten years of the 30 year project life; and
- Following completion of the cap, the fence will be inspected and repaired or replaced as necessary.

In order to limit the amount of dust generated by construction activities, water will be sprayed onto contaminated soil as needed until construction has reached the point where contaminated soils are completely covered by clean fill, gravel, and/or asphalt. Air samples will be collected and tested for contaminant levels throughout cap construction.

## Construction Monitoring

During construction activities, the quality of the work will be periodically inspected. Several tests which are commonly used to measure compliance with contract specifications will be performed. These tests will include, but may not be limited to the following:

- **Modified Proctor test** (Moisture-Density relationship) of clean fill and gravel materials which are to be used in the foundation layer of the asphalt cap;

- Testing of clean fill after it has been compacted to verify that the proper density has been achieved;

- Testing of the gravel layer after it has been compacted to verify that the proper density has been achieved; and

- Testing of the asphalt base layer after it has been compacted to verify that the proper density and thickness have been achieved;

## Health and Safety Monitoring

Site work activities will create a temporary increase in airborne dust and therefore a short-term health risk to the public. However, dust control measures and air sampling will be used to minimize the threat to site workers and the public.

Air sampling will be conducted by a trained specialist during all construction activities that might create contaminated airborne dust which could move off-site into the surrounding neighborhood. This sampling typically consists of collecting samples of airborne dust in the work area and at various other locations using high volume air samplers. Some samplers will be located upwind of the site to indicate normal background levels and others would be placed downwind of the site to capture emissions produced by the work activities. Samples will be regularly tested to assess the level of contaminated dust.

If the levels of dust or contaminants of concern (lead, arsenic, and/or asbestos) exceed established allowable levels, construction will be stopped and work methods modified so that airborne contaminants are reduced to acceptable levels. If the wind speed ever rises above the limit that is set in the Site Health and Safety Plan or existing permits, all construction work will stop until the wind dies down to an acceptable speed. If it becomes necessary, site workers may be required to use **personal protective equipment** (such as air-purifying respirators and protective suits) to prevent breathing and/or swallowing contaminated dust and to prevent contamination of clothing and skin. If necessary, signs will be posted around the site to inform the public of any safety risks.

Prior to initiation of site work, the DTSC will be informed in writing of any additional monitoring which may be required as a result of permit restrictions. These will also be incorporated into the Site Health and Safety Plan and/or the Remedial Design Work Plan. All on-site personnel will be properly trained in accordance with the **Occupational Safety and Health Act** and equipped with personal protective equipment as specified in the Site Health and Safety Plan. Workers will be checked frequently during site work to verify compliance with the Site Health and Safety Plan.

Environmental Impacts

Implementation of this alternative will likely create short-term environmental impacts caused by construction activities. These impacts are expected to include increased noise on the site and in the vicinity, increased truck traffic, and odor from asphalt paving activities. However, the level of air emissions during cap construction is not expected to be significantly greater than that associated with normal urban activity (such as paving streets), and should not result in significant environmental impacts. The impact of noise and traffic is expected to be low because site work is planned for daylight hours during the week when most people are away from their homes.

The long-term environmental benefits afforded by this alternative include eliminating off-site movement of contaminated soil in the form of airborne dust and greatly reducing infiltration of rainwater and downward migration of contaminants to groundwater. This will effectively eliminate the primary exposure pathways for people and other biological receptors.

### 6.2.2 Operable Unit S-2

#### 6.2.2.1 Alternative 1: No Action

Objectives and Scope

The National Oil and Hazardous Substances Pollution Contingency Plan requires that the No Action Alternative be considered. The amount of risk reduction provided by each of the other final candidate alternatives is compared to the No Action Alternative to assess how effective they are. This alternative involves no remediation (clean-up) of contaminated soil; it consists primarily of constructing and maintaining a fence around the entire site to prevent unauthorized access. A land use covenant would be entered into by DTSC and UPRR. The land use covenant would be noticed on the deed to the property to regulate future land uses and activities on the property which might disturb soil contaminants and cause human health risks and/or adverse environmental impacts. In addition, groundwater beneath the site would be monitored for a period of thirty years to check for changes in groundwater quality caused by migration of contaminants from soil. A report which discusses groundwater monitoring results would be submitted to the DTSC on a yearly basis.

Cost Effectiveness

This alternative has the lowest total present worth cost of all the alternatives being considered for Operable Unit S-2. The total present worth cost of this alternative is approximately $731,000. This total includes both capital costs and Operation and Maintenance (O&M) costs. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years.

Capital costs (for equipment, labor, and materials) are approximately $30,000. This includes the cost of repairing and/or replacing the existing fence which surrounds the site. Operation and maintenance costs are approximately $1,170,000. This includes the costs for groundwater monitoring and preparation of an annual report.

Implementation Time

Since this alternative does not include any remediation of contaminated soil, the time needed to put this alternative into effect (implementation time) is expected to be approximately three months. This includes time needed to prepare a groundwater monitoring work plan, construct and/or repair the existing fence, develop the land use covenant and notice the requirements on the property deed, and get DTSC approval for the work plan.

Groundwater Use

Of all the final candidate alternatives which were considered, this alternative presents the greatest risk to groundwater quality because none of the contaminated soil or buried debris which includes drums in S-2 would be removed or treated to reduce the level of contamination in this area. As a result, contaminants could migrate to groundwater and thus pose a threat to human health and the environment. The soil contaminants and/or buried drums in this Operable Unit are believed to be the primary source of existing groundwater contamination beneath the site. The thirty-year groundwater monitoring program would be designed to provide an early warning of any additional groundwater contamination which might occur after implementation of this alternative is complete.

### Environmental Impact

Because this alternative does not include any remediation of contaminated soil or buried drums which are believed to be the primary source of existing groundwater contamination, it would result in potential adverse environmental impacts including contaminant migration either to groundwater or off-site in the form of airborne dust. Of all the final candidate alternatives, this alternative provides the least long-term protection of the environment.

### Justification for Rejection or Selection

This alternative was rejected from consideration as the recommended remedial alternative because it would not meet Remedial Action Objectives and would not provide adequate protection of human health and the environment. It would not reduce the toxicity, mobility, or volume of the contaminants at the site, nor would it eliminate the need for long-term access restrictions, deed notices or groundwater monitoring.

## 6.2.2.2 Alternative 6: Excavation/Off-Site Disposal of Hot Spots with Capping

### Objectives and Scope

This alternative consists of excavation and off-site disposal of soils contaminated with lead, arsenic, and/or petroleum hydrocarbons at or above Hot Spot levels. Excavated soil would be loaded onto either rail cars or trucks and taken off-site and disposed of in an appropriately licensed and permitted landfill. Drums contained in buried debris which may be present in this Operable Unit would be located and brought to the surface, and examined for contents. Any drums containing potentially hazardous substances would be placed in a protective overpack container. The contents would be catalogued and tested as necessary to characterize the drummed material. Following adequate characterization of the drum contents, the drums would be transported to an appropriate waste disposal facility. Depending on the contents, disposal may consist of off-site incineration, recycling, and/or disposal in a fully licensed and permitted landfill.

In order to verify that all the Hot Spot soil has been removed, soil samples would be taken from the bottom and sides of the excavation pits. The samples would be sent to a laboratory and tested for arsenic, lead, and/or petroleum hydrocarbons. If the testing shows that there is still soil in the pits that is contaminated above the Hot Spot levels, excavation would continue until test results indicate that the pits have been cleaned up to the desired level.

Clean soil brought from off-site would be placed in the pits created during excavation of the Hot Spot soils. An asphalt cap would then be constructed over the areas where the remaining soil contains contamination greater than the Remedial Action Objectives. The cap would also cover the backfilled pits. The cap would be designed to reduce movement of rainwater downward through the contaminated soil toward groundwater and prevent contaminated soil from being blown off-site by wind.

During construction (especially at those times when contaminated soil is being moved or otherwise disturbed), soil would be wetted down by a water truck equipped with a sprinkler attachment to minimize the amount of dust raised by these activities. Samples of air from the site and vicinity would be collected and analyzed during all construction activities. If analysis of air samples shows that dust from results in a significant risk to human health or the environment, construction would be stopped until dust generation can be mitigated.

In addition to construction of the cap, the site would be fenced to restrict unauthorized access. The asphalt cap would be inspected yearly so that repairs, if necessary, could be made. Regular maintenance of the asphalt surface would include re-sealing one-fourth of the entire cap every year in rotation so that the entire cap is resealed every four years. Additionally, the cap surface would be replaced with fresh asphalt every ten years. This maintenance program is designed to keep the cap in good condition.

Because this alternative would remove the major source of potential groundwater contamination from S-2, it does not include groundwater monitoring. However, residual levels of contamination above the Remedial Action Objectives wold be left in soil. Therefore, a land use covenant would be entered into by DTSC and UPRR. The land use covenant would be noticed on the deed to the property to regulate future land uses and activities on the property which might disturb soil contaminants and cause human health risks or adverse environmental impacts.

Cost Effectiveness

This is the second most expensive alternative being considered for Operable Unit S-2. It is less expensive than Alternative 10, but more expensive than Alternative 1. The total present worth cost of this alternative is $4,501,000. This total includes both capital costs and Operation and Maintenance (O&M) costs. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years.

Capital costs (for equipment, labor, and materials) would be approximately $4,570,000. This includes the cost of excavating and disposing of the Hot Spot soil and buried drums, all construction activities, and repairing and/or replacing the existing fence which surrounds the site. Operation and maintenance costs would be approximately $298,000. This includes costs for cap maintenance and replacement.

## Implementation Time

The time needed to implement this alternative is expected to be 10 months. This includes three months for engineering design of the cap, three months to obtain the necessary permits, and seven months to clear and grade the site, excavate and dispose of Hot Spot soils and buried drums, backfill excavations with clean imported soil, and construct the asphalt cap and fence. It is expected that design of the cap would be completed during the same time as permitting. Completion of the project could be delayed if either permit approval or design are delayed, or if unplanned difficulties occur during excavation or cap construction. Because the location and quantity of buried drums is not precisely known, site work delays or extensions are more likely for this Operable Unit than they are for others.

## Groundwater Use

Groundwater use will not be significantly affected by this alternative. Disposing of Hot Spot soil and buried drums off-site would significantly reduce both the volume of contaminated soil and mobility of contaminants so that they would be less likely to move downward into groundwater. In addition, the cap would reduce the amount of rainwater which is available to mobilize remaining contaminants and cause them to move downward into the groundwater. This alternative is therefore more likely to protect the groundwater than Alternative 1, but less likely than Alternative 10.

## Environmental Impact

Dust generation is expected to be higher for this alternative than for Alternative 1, but less than Alternative 10 because this alternative includes less on-site handling of soil. Dust control measures would be used during site clearing, grading, excavation, and construction activities to reduce generation of contaminated airborne dust. Due to the nature of asphaltic material, there would likely be some odor during paving of the asphalt cap. However, the level of air emissions caused by cap construction is not expected to be significantly greater than that associated with normal urban activity (such as paving streets), and should not result in significant environmental impacts. There would also be some increased noise and traffic at and near the site during the hours when site work is underway. However, the impact of noise and traffic is expected to be low because site work would be planned for daylight hours during the week when most people are away from their homes.

### Justification for Rejection or Selection

This alternative would reduce both the volume and mobility of soil contaminants at the site. Removal of the contaminated soil and drums which may be contained in buried debris is expected to eliminate the primary source of groundwater contamination beneath the site. Therefore, this alternative would effectively eliminate the most significant means of human exposure to soil contaminants and environmental impacts, and thus provide adequate protection of human health and the environment.

The implementation time for this alternative is higher than Alternative 1, and about the same as that for Alternative 10 for this operable unit. This is the second most expensive of the alternatives for this operable unit; Alternative 10 would cost more and Alternative 1 would cost less.

Because removing Hot Spot soils and possible buried drums prior to capping will provide adequate protection of human health and the environment at a relatively low cost, with relatively moderate short-term environmental impacts, this alternative was selected as the recommended remedial alternative for Operable Unit S-2.

#### 6.2.2.3 Alternative 10: Excavation/Off-Site Disposal of Soil Above Remedial Action Objectives

### Objectives and Scope

This alternative consists of excavation and off-site disposal of the soil contaminated with petroleum hydrocarbons, lead and/or arsenic at or above the Remedial Action Objectives. After the site is cleared and construction debris disposed of off-site, excavated soil would be loaded onto either rail cars or trucks and taken off-site and disposed of in an appropriately licensed and permitted landfill. The drums which may be present in buried debris in this Operable Unit would be located, brought to the surface, and if contents are observed, placed in protective overpack containers. The contents would be catalogued and tested as necessary to characterize the drummed material. Following characterization of the drum contents, the drums would be transported to an appropriate waste disposal facility. Depending on the contents, disposal may consist of off-site incineration, recycling, and/or disposal in an appropriately licensed and permitted landfill. Clean soil brought from off-site would be placed in the pits created during excavation.

During construction (especially at those times when contaminated soil is being moved or otherwise disturbed), soil would be wetted down by a water truck equipped with a sprinkler attachment to minimize the amount of dust raised by these activities. Samples of air from the site and vicinity would be collected and analyzed during all construction activities. If analysis of air samples shows that dust from construction activities results in a significant risk to human health or the environment, construction would be stopped until dust generation can be mitigated.

In order to verify that the soil contaminated above the Remedial Action Objectives has been removed, soil samples would be taken from the bottom and sides of the excavation pits. The samples would be sent to a laboratory and tested for arsenic, lead, and/or petroleum hydrocarbons, as appropriate. If the testing shows that there is still soil in the pits that is contaminated above the Remedial Action Objectives, excavation would continue until test results indicate that the pits have been cleaned up to the desired level.

Because this alternative provides for the removal of the buried drums and soil contaminated above the Remedial Action Objectives, a fence, a land use covenant and notice to the deed, and groundwater monitoring are not included as part of this alternative.

Cost Effectiveness

This is the most expensive alternative being considered for Operable Unit S-2. The total present worth cost of this alternative is approximately $11,247,000. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years. This includes capital costs for equipment, labor, and materials. It also includes the cost of excavating and disposing of all buried drums and soil contaminated above the Remedial Action Objectives, and all related construction activities. There would be no operation and maintenance costs associated with this alternative.

Implementation Time

The time needed to implement this alternative is expected to be nine months. This includes two months for engineering design, three months to obtain the necessary permits, and six months to clear the site, excavate and dispose of the soil and drums, and backfill the pits. It is expected that design and permitting would begin at the same time. Completion of the project could be delayed if permit approval is delayed, or if unplanned delays occur during excavation. Because the location and quantity of buried drums is not precisely known, site work delays or extensions are more likely for this Operable Unit than they are for others.

Groundwater Use

Groundwater use will not be affected by this alternative. Disposing of possible drums contained in buried debris and soil contaminated above the Remedial Action Objectives would effectively eliminate contaminants that could move downward into groundwater. This alternative is therefore likely to protect the groundwater more than any of the other final candidate alternatives.

Environmental Impact

Dust generation is expected to be higher for this alternative than for all other alternatives because of the large volume of soil that would need to be excavated and disposed of. Dust control measures would be used during site clearing, grading, excavation, and construction activities to reduce the generation of contaminated airborne dust. There would also be some increased noise and traffic at and near the site during the hours when site work is underway. However, the impact of noise and traffic is expected to be low because site work is planned for daylight hours during the week when most people are away from their homes.

Justification for Rejection or Selection

This alternative would reduce both the volume and mobility of soil contaminants in this Operable Unit. This alternative would effectively eliminate the most significant means of human exposure to soil contaminants and environmental impacts, and would thus provide adequate protection of human health and the environment.

The implementation time for this alternative is higher than Alternative 1, but about the same as Alternative 6 for this operable unit. This is the most expensive of the alternatives for this operable unit. Because the potential benefits of removing all soil contaminated above the Remedial Action Objectives do not justify the significantly greater short-term environmental impacts, human health risk, and cost, this alternative was rejected as the recommended remedial alternative for Operable Unit S-2.

6.2.2.4 Recommended Remedial Alternative

The recommended remedial alternative for Operable Unit S-2 is Alternative 6. This alternative consists of off-site disposal of possible drums contained in buried debris and soils contaminated above the Hot Spot levels, constructing an asphalt cap to cover remaining soil contaminated above the Remedial Action Objectives, construction and/or repair of a fence around the site to restrict access, developing a land use covenant and placing a notice on the deed to the property to regulate future land uses and activities on the property so that remaining contaminants are not disturbed. Operation and maintenance will consist of maintaining the fence and repairing and replacing portions of the asphalt cap as necessary.

Justification for Selection

Alternative 6 was selected as the recommended remedial alternative for Operable Unit S-2 for the following reasons:

- It would eliminate the primary source of present and future groundwater contamination;

- It would effectively eliminate the primary exposure pathways (inhalation of contaminated dust and ingestion of contaminated soil);

- It would significantly reduce downward movement of rainwater through contaminated soils, thereby providing good groundwater quality protection;

- It provides better short-term protection of human health and the environment than the other alternative which includes excavation of contaminated soil above Remediation Action Objectives (Alternative 10);

- The technologies used (excavation, landfilling, and capping) are well-tested, proven and easy to implement;

- It provides adequate overall long-term protection of human health and the environment; and

- It is the most cost-effective of all final candidate alternatives for this Operable Unit, except for Alternative 1.

Following approval of this Remedial Action Plan, a Remedial Design Work Plan will be prepared. It will provide detailed design specifications for the recommended remedial alternative for this Operable Unit, a Site Health and Safety Plan, and an Operation and Maintenance Plan. After the Remedial Design Work Plan is prepared, it will be submitted to the DTSC for review and approval.

Design Activities

The asphalt cap will be designed to be consistent with future potential land uses. The cap is expected to be designed with a minimum one percent slope to provide natural drainage away from the cap. Drainage channels will be constructed as necessary to divert runoff into existing sanitary sewers surrounding the site. The engineering design of the asphalt cap would include several design documents and drawings which would be incorporated into the Remedial Design Work Plan. These documents may include the following:

- Grading design drawings;
- Asphalt cap design drawings;
- Cap construction specifications;
- Equipment and material lists; and
- Subcontractor bid and performance specifications.

Because of the large areal extent and relative shallowness expected for the excavation in this Operable Unit, no shoring is expected to be needed. The pit will be planned and excavated so that its walls will have stable slopes.

Several permits are likely to be required. Some of these may include an air emissions permit from the Sacramento Metropolitan Air Quality Management District and a construction permit from the City of Sacramento Building Department.

<u>Construction Activities</u>

After the Remedial Design Work Plan is prepared, it will be submitted to the DTSC for review and approval. Construction activities will begin only after DTSC approval is received. Site work and construction will probably take place in the following order:

- The site will be cleared and grubbed (shrubs, trees, and debris will be removed and disposed of off-site);
- The fence that currently surrounds the site will be repaired or reconstructed as necessary to prevent unauthorized access to the site during construction activities;
- Hot Spot soils will be excavated and loaded onto either railcars or trucks for transport off-site. The transport vehicles will be covered to prevent load loss in transit;

- Possible buried drums which may be present will be located using **electromagnetic surveying** and/or **ground-penetrating radar** techniques. Once located, the drums will be carefully excavated to minimize risk of puncture. Each drum (except those which are empty) will be placed in a protective overpack to prevent leakage. Following **waste characterization,** the drums will be taken off-site for recycling or other disposal as required;

- Clean soil (clean fill) will be brought from another location, placed in excavation pits, and graded to the appropriate surface shape so that rainwater will flow naturally off the finished cap. As the clean fill is placed in thin layers, it will be compacted using special equipment to provide a stable base for the asphalt cap;

- A layer of gravel will be placed over the soil foundation and compacted;

- Two separate layers of asphalt will be applied on top of the gravel layer. The first layer, approximately 4 inches thick, will be the base layer. The second layer, which is sometimes called a Petromat Overlay, is approximately two inches thick and will be separated from the base layer by a special fabric and sealant. This second layer is designed to increase the life of the base layer by protecting it from wear, sunlight, and weather. This second layer is the part of the cap that will be replaced every ten years of the 30 year project life; and

- Following completion of the cap, the fence will be inspected and repaired or replaced as necessary.

In order to limit the amount of dust generated by construction activities, water will be sprayed onto contaminated soil as needed until construction has reached the point where contaminated soils are completely covered by clean fill, gravel, and/or asphalt. Air samples will be collected and tested for contaminant levels throughout excavation, backfilling and cap construction.

Construction Monitoring

During construction activities, the quality of the work will be inspected at appropriate intervals as specified in the Remedial Design Work Plan. Several tests which are commonly used to measure compliance with contract specifications will be performed. These tests will include, but may not be limited to the following:

- Modified Proctor test (Moisture-Density relationship) of clean fill and gravel materials which are to be used in the foundation layer of the asphalt cap;

- Testing of the clean fill after it has been compacted to verify that the proper density has been achieved;

- Testing of the gravel layer after it has been compacted to verify that the proper density has been achieved; and

- Testing of the asphalt base layer after it has been compacted to verify that the proper density and thickness have been achieved;

<u>Health and Safety Monitoring</u>

Site work activities will create a temporary increase in airborne dust and therefore a short-term health risk to the public. However, dust control measures and air sampling will be used to minimize the threat to site workers and the public.

Air sampling will be conducted by a trained specialist during all construction activities that might create contaminated airborne dust which could move off-site into the surrounding neighborhood. This sampling typically consists of collecting samples of airborne dust in the work area and at various other locations using high volume air samplers. Some samplers will be located upwind of the site to indicate normal background levels and others will be placed downwind of the site to capture emissions produced by the work activities. Samples would be regularly tested to assess the level of contaminated dust.

If the levels of dust or contaminants of concern (lead, arsenic, and/or petroleum hydrocarbons) exceed established allowable levels, construction will be stopped and work methods modified so that airborne contaminants are reduced to acceptable levels. If the wind speed ever rises above the limit that is set in the Site Health and Safety Plan or existing permits, all construction work will stop until the wind dies down to an acceptable speed. If it becomes necessary, site workers may be required to use personal protective equipment (such as air-purifying respirators and protective suits) to prevent breathing and/or swallowing contaminated dust and to prevent contamination of clothing and skin. If necessary, signs will be posted around the site to inform the public of any safety risks.

Prior to initiating excavating, the DTSC will be informed in writing of any additional monitoring which may be required as a result of permit restrictions. These will be incorporated into the Site Health and Safety Plan and/or the Remedial Design Work Plan. All on-site personnel will be properly trained in accordance with the Occupational Safety and Health Act and equipped with personal protective equipment as specified in the Site Health and Safety Plan. Workers will be checked frequently during site work to verify compliance with the Site Health and Safety Plan.

Environmental Impacts

Implementation of this alternative will likely create short-term environmental impacts caused by construction activities. These impacts are expected to include increased noise on the site and in the vicinity, increased truck traffic, and odor from asphalt paving activities. However, the level of air emissions during cap construction is not expected to be significantly greater than that associated with normal urban activity (such as paving streets), and should not result in significant environmental impacts. The impact of noise and traffic is expected to be low because site work is planned for daylight hours during the week when most people are away from their homes.

The long-term environmental benefits afforded by this alternative include eliminating off-site movement of contaminated soil in the form of airborne dust and greatly reducing infiltration of rainwater and downward migration of contaminants to groundwater. This will effectively eliminate the primary exposure pathways for people and other biological receptors.

### 6.2.3 Operable Unit S-3

#### 6.2.3.1 Alternative 1: No Action

Objectives and Scope

The National Oil and Hazardous Substances Pollution Contingency Plan requires that the No Action Alternative be considered. The amount of risk reduction provided by each of the other final candidate alternatives is compared to the No Action Alternative to assess how effective they are. This alternative involves no remediation (clean-up) of contaminated soil; it consists primarily of constructing and maintaining a fence around the entire site to prevent unauthorized access. A land use covenant would be entered into by DTSC and UPRR. The land use covenant would be noticed on the deed to the property to regulate future land uses and activities on the property which might disturb soil contaminants and cause human health risks and/or adverse environmental impacts. In addition, groundwater beneath the site would be monitored for a period of thirty years to check for changes in groundwater quality caused by the migration of contaminants in soil. A report which discusses groundwater monitoring results would be submitted to the DTSC on a yearly basis.

## Cost Effectiveness

This alternative has the lowest total present worth cost of all the alternatives being considered for Operable Unit S-3. The total present worth cost of this alternative is approximately $753,000. This total includes both capital costs and Operation and Maintenance (O&M) costs. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years.

Capital costs (for equipment, labor, and materials) are approximately $53,000. This includes the cost of repairing and/or replacing the existing fence which surrounds the site. Operation and maintenance costs are approximately $1,170,000. This includes the costs for groundwater monitoring and preparation of an annual report.

## Implementation Time

Since this alternative does not include any remediation of contaminated soil, the time needed to put this alternative into effect (implementation time) is expected to be approximately three months. This includes time needed to prepare a groundwater monitoring work plan, construct and/or repair the existing fence, develop the land use covenant and notice the property deed, and get DTSC approval for the work plan.

## Groundwater Use

Of all the final candidate alternatives which were considered, this alternative presents the greatest risk to groundwater quality because none of the contaminated soil in S-3 would be removed or treated to reduce the level of contamination in this area. As a result, these contaminants could migrate to groundwater and thus pose a threat to human health and the environment. The thirty-year groundwater monitoring program would be designed to provide an early warning of any groundwater contamination which might occur after implementation of this alternative is complete.

## Environmental Impact

Because this alternative does not include any remediation of contaminated soil, it would result in potential significant adverse environmental impacts including contaminant migration either to groundwater or off-site in the form of airborne dust. Of all the final candidate alternatives, this alternative provides the least long-term protection of the environment.

Justification for Rejection or Selection

This alternative was rejected from consideration as the recommended remedial alternative because it would not meet Remedial Action Objectives and would not provide adequate protection of human health and the environment. It would not reduce the toxicity, mobility, or volume of the contaminants at the site, nor would it eliminate the need for long-term access restrictions, deed notices or groundwater monitoring.

6.2.3.2 Alternative 4: Containment with Institutional Controls

Objectives and Scope

If this alternative were chosen, all contaminated soil would be left in place on the site. Debris would be cleared away, the surface soils would be graded, and asphalt caps would be constructed to cover soils contaminated above the Remedial Action Objectives. Two separate caps would be constructed because there are two geographically separate areas in this Operable Unit containing contaminated soil. The caps would be designed to reduce movement of rainwater downward through contaminated soil to groundwater and prevent contaminated soil from being blown off-site by wind. The caps would be built so that water naturally flows away from the capped areas.

During construction (especially at those times when contaminated soil is being moved or otherwise disturbed), soil would be wetted down by a water truck equipped with a sprinkler attachment to minimize the amount of dust raised by these activities. Samples of air from the site and vicinity would be collected and analyzed during all construction activities. If analysis of air samples shows that dust from construction activities results in a significant risk to human health or the environment, construction would be stopped until dust generation can be mitigated.

The completed asphalt caps would be inspected yearly so that repairs, if necessary, could be made. Regular maintenance of the asphalt surface would include re-sealing one-fourth of each cap every year in rotation so that each of the two caps is completely resealed every four years. Additionally, the cap surface would be replaced with fresh asphalt every ten years. This maintenance program is designed to keep the caps in good condition.

In addition to construction of caps over areas where soil is contaminated above the Remedial Action Objectives, a land use covenant would be entered into by DTSC and UPRR. The land use covenant would be noticed on the deed to the property to regulate future land uses and activities on the property which might disturb soil contaminants and cause human health risks or adverse environmental impacts. The site would be fenced to restrict unauthorized access. Groundwater quality would be monitored for a period of thirty years after the cap is finished. A report which discusses the results of groundwater monitoring would be submitted to DTSC on a yearly basis.

Cost Effectiveness

This alternative has the second highest total present worth cost of all the alternatives being considered for Operable Unit S-3. Only Alternative 10 would cost more. The total present worth cost of this alternative is approximately $1,480,000. This total includes both capital costs and Operation and Maintenance (O&M) costs. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years.

Capital costs (for equipment, labor, and materials) are approximately $659,000. This includes the cost of all construction activities and repairing and/or replacing the existing fence which surrounds the site. Operation and maintenance costs would be approximately $1,469,000. This includes the cost for cap maintenance and replacement, the groundwater monitoring program and yearly monitoring reports.

Implementation Time

The time needed to implement this alternative is expected to be six months. This includes three months for engineering design of the cap, three months to obtain the necessary permits, and three months to clear and grade the site and construct the asphalt cap and fence. It is expected that design of the cap would be conducted during the same time as permitting. Completion of the project could be delayed if either permit approval or design are delayed, or if unplanned difficulties occur during construction.

Groundwater Use

Groundwater use will not be significantly affected by this alternative. One purpose of the cap is to reduce the amount of water moving downward through contaminated soil and into groundwater. This alternative is therefore more likely to protect groundwater than Alternative 1, but less likely than Alternatives 5, 6, and 10. The thirty-year groundwater monitoring program would be designed to provide an early warning of any groundwater contamination which might occur because of the downward movement of soil contaminants.

Environmental Impact

Dust control measures would be used during site clearing, grading, and construction activities to reduce generation of contaminated airborne dust. Due to the nature of asphaltic material, there would be some odor during paving of the asphalt cap. However, the level of air emissions during cap construction is not expected to be significantly greater than that associated with normal urban activity (such as paving streets), and should not result in significant environmental impacts. There would also be some increased noise and traffic at and near the site during the hours when site work is underway. However, the impact of noise and traffic is expected to be low because site work would be planned for daylight hours during the week when most people are away from their homes.

Justification for Rejection or Selection

This alternative would greatly reduce the mobility of the contaminants at the site. Although it would not reduce the toxicity of the contaminants or the volume of contaminated soil, it would effectively eliminate the most significant means of human and environmental exposure to the soil contaminants. Thus, it would provide adequate protection of human health and the environment.

This alternative is more expensive than Alternatives 1, 5, and 6, but less expensive than Alternative 10. It would require about the same time to implement, but would cause fewer short-term environmental impacts during implementation than all other final candidate alternatives, except Alternative 1. However, this Operable Unit would be relatively easy to reclaim for future beneficial land uses if another remedial alternative were chosen. Alternative 4 would allow for only very limited future use. Therefore, this alternative was rejected as the recommended remedial alternative for Operable Unit S-3.

#### 6.2.3.3 Alternative 5: Excavation/On-Site Treatment of Hot Spots with Capping

Objectives and Scope

This alternative consists of excavation and on-site treatment of soils contaminated with lead and/or arsenic at or above Hot Spot levels. The soil would be treated using a technology called soil washing. After the site is cleared and existing debris disposed of off-site, contaminated soil would be excavated and brought to an on-site treatment area where it would be placed into a soil washing machine. Inside the machine, the soil would be mixed with a solution of chemicals which would remove much of the arsenic and/or lead from the soil particles. When soil washing is complete, the levels of arsenic and lead in the soil would be significantly less because the contaminants would have been transferred to the washing solution. The by-products of soil washing are (1) a contaminated washing solution (liquor), and (2) a small amount of soil that is much more contaminated than it was before treatment. The liquor and highly contaminated soil would be taken off-site and disposed of in an appropriately licensed and permitted landfill. Treated soil would be placed back in the excavations from which it was removed.

After excavation, and before backfilling of treated soil occurs, soil samples would be taken from the bottom and sides of the excavation pits to verify that all Hot Spot soil has been removed and treated. The samples would be sent to a laboratory and tested for arsenic and lead. If the testing shows that there is still soil in the pits that is contaminated above Hot Spot levels, excavation would continue until test results indicate that the pits have been cleaned up to the desired level.

After the excavations have been backfilled with treated soil, asphalt caps would be constructed over the two geographically separate areas where there is untreated soil which contains contamination greater than the Remedial Action Objectives. The caps would also cover the treated soil. These caps would be designed to reduce movement of rainwater downward through the contaminated soil into the groundwater beneath the site and prevent contaminated soil from being blown off-site by wind. During construction and following completion of the asphalt caps, the site would be fenced to prevent unauthorized access.

During construction (especially at those times when contaminated soil is being moved or otherwise disturbed), soil would be wetted down by a water truck equipped with a sprinkler attachment to minimize the amount of dust raised by these activities. Samples of air from the site and vicinity would be collected and analyzed during all construction activities. If analysis of air samples shows that dust from construction activities results in a significant risk to human health or the environment, construction would be stopped until dust generation can be mitigated.

The asphalt caps would be inspected yearly so that repairs, if necessary, could be made. Regular maintenance of the asphalt surface would include re-sealing one-fourth of each cap every year in rotation so that each cap is completely resealed every four years. Additionally, the cap surfaces would be replaced with fresh asphalt every ten years. This maintenance program is designed to keep the cap in good condition.

Because this alternative would remove the major source of potential groundwater contamination and off-site migration of contaminants from S-3 through soil treatment and capping, groundwater monitoring is not included in this alternative. However, residual levels of contamination above the Remedial Action Objectives wold be left in soil. Therefore, a land use covenant would be entered into by DTSC and UPRR. The land use covenant would be noticed on the deed to the property to regulate future land uses and activities on the property which might disturb soil contaminants and cause human health risks or adverse environmental impacts.

## Cost Effectiveness

This is the third most expensive alternative being considered for Operable Unit S-3. It is less expensive than Alternatives 4 and 10, but more expensive than Alternatives 1 and 6. The total present worth cost of this alternative is approximately $845,000. This total includes both capital costs and Operation and Maintenance (O&M) costs. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years.

Capital costs (for equipment, labor, and materials) would be approximately $730,000. This includes the cost of all construction activities, soil washing, and repairing and/or replacing the existing fence which surrounds the site. Operation and maintenance costs would be approximately $299,000. This includes costs for cap maintenance and replacement.

## Implementation Time

The time needed to implement this alternative is expected to be seven and one-half months. This includes three months for engineering design of the cap, three months to obtain the necessary permits, and four and one-half months to clear and grade the site, excavate and treat Hot Spot soils, backfill excavations with clean imported soil, and construct the asphalt cap and fence. It is expected that design of the caps would be started at the same time as permitting. Completion of the project could be delayed if either permit approval or design are delayed, or if unplanned difficulties occur during excavation, soil washing or cap construction.

## Groundwater Use

Groundwater use will not be significantly affected by this alternative. Soil washing would significantly reduce the level of soil contamination, so that contaminants would be less likely to move downward into groundwater. In addition, one purpose of the cap is to reduce the amount of rainwater moving downward through contaminated soil and into groundwater. This alternative is therefore more likely to protect the groundwater than Alternatives 1 and 4, but less likely than Alternatives 6 and 10.

## Environmental Impact

Because of the extensive excavation and soil-handling activities associated with excavation and the soil washing procedure, dust generation is expected to be higher for this alternative than for Alternatives 1, 4, and 6. However, dust control measures would be used during site clearing, grading, excavation, soil washing, and construction activities to minimize generation of contaminated airborne dust. Due to the nature of asphaltic material, there would be some odor during paving of the asphalt cap. However, the level of air emissions caused by cap construction is not expected to be significantly greater than that associated with normal urban activity (such as paving streets), and should not result in significant environmental impacts. There would also be some increased noise and traffic at and near the site during the hours when site work is underway. However, the impact of noise and traffic is expected to be low because site work would be planned for daylight hours during the week when most people are away from their homes.

Justification for Rejection or Selection

This alternative would reduce the toxicity, mobility, and volume of soil contaminants. It would effectively eliminate the most significant means of human exposure to the soil contaminants and environmental impacts, and would thus provide adequate protection of human health and the environment.

Despite these advantages it should be noted that soil washing has not been proven for arsenic and lead. In the past it has been primarily used to remove petroleum hydrocarbons from soil. Furthermore, there are few qualified contractors who are experienced in this type of treatment and can provide sufficient equipment to complete the job in a reasonable time. For this reason, a treatability study must be performed on contaminated soil from the site to assess how successful soil washing would be and how long the treatment process would take to reduce contamination to an acceptable level. Until this is done, the implementation time for this alternative cannot be predicted accurately. This alternative is therefore assumed to be the most time-consuming of all the final candidate alternatives being considered for this operable unit because soil washing can take a long time, particularly with the types of soils that are present at the site (i.e., silts and clays). This is the third most expensive of the alternatives for this operable unit; Alternatives 4 and 10 are the only ones that would cost more. Because of the uncertainty regarding the success of soil washing and the potential environmental impact of an extended implementation period, the potential problems associated with this alternative are greater than the potential benefits. Therefore, this alternative was rejected as the recommended remedial alternative for Operable Unit S-3.

#### 6.2.3.4 Alternative 6: Excavation/Off-Site Disposal of Hot Spots with Capping

Objectives and Scope

This alternative consists of excavation and off-site disposal of soils contaminated with lead and/or arsenic at or above Hot Spot levels. Excavated soil would be loaded onto either rail cars or trucks and taken off-site and disposed of in an appropriately licensed and permitted landfill.

In order to verify that the Hot Spot soil has been removed, soil samples would be taken from the bottom and sides of the excavation pits. The samples would be sent to a laboratory and tested for arsenic and lead. If the testing shows that there is still soil in the pits that is contaminated above the Hot Spot levels, excavation would continue until test results indicate that the pits have been cleaned up to the desired level.

Clean soil brought from off-site would be placed in the pits created during excavation of the Hot Spot soils. Asphalt caps would then be constructed over the two separate areas where the remaining soil contains contamination greater than the Remedial Action Objectives. The caps would also cover the backfilled pits. The caps are designed to reduce movement of rainwater downward through the contaminated soil toward groundwater and prevent contaminated soil from being blown off-site by wind.

During construction (especially at those times when contaminated soil is being moved or otherwise disturbed), soil would be wetted down by a water truck equipped with a sprinkler attachment to minimize the amount of dust raised by these activities. Samples of air from the site and vicinity would be collected and analyzed during all construction activities. If analysis of air samples shows that dust from construction activities results in a significant risk to human health or the environment, construction would be stopped until dust generation can be mitigated.

In addition to construction of caps, the site would be fenced to restrict unauthorized access. The asphalt caps would be inspected yearly so that repairs, if necessary, could be made. Regular maintenance of the asphalt surface would include re-sealing one-fourth of each cap every year in rotation so that both caps are completely resealed every four years. Additionally, the cap surfaces would be replaced with fresh asphalt every ten years. This maintenance program is designed to keep the caps in good condition.

Because this alternative would remove the major source of potential groundwater contamination and off-site contaminant migration from S-3, groundwater monitoring is not included in this alternative. However, residual levels of contamination above the Remedial Action Objectives wold be left in soil. Therefore, a land use covenant would be entered into by DTSC and UPRR. The land use covenant would be noticed on the deed to the property to regulate future land uses and activities on the property which might disturb soil contaminants and cause human health risks or adverse environmental impacts.

Cost Effectiveness

This is the fourth most expensive alternative being considered for Operable Unit S-3. It is less expensive than Alternatives 4, 5, and 10, but more expensive than Alternative 1. The total present worth cost of this alternative is approximately $804,000. This total includes both capital costs and Operation and Maintenance (O&M) costs. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years.

Capital costs (for equipment, labor, and materials) would be approximately $688,000. This includes the cost of excavating and disposing of the Hot Spot soil, all construction activities, and repairing and/or replacing the existing fence which surrounds the site. Operation and maintenance costs would be approximately $299,000. This includes the costs for cap maintenance and replacement.

Implementation Time

The time needed to implement this alternative is expected to be six and one-half months. This includes two months for engineering design of the caps, three months to obtain the necessary permits, and three and one-half months to clear and grade the site, excavate and dispose of Hot Spot soils, backfill the excavations with clean imported fill, and construct the asphalt cap and fence. It is expected that design of the cap would be conducted during the same time as permitting. Completion of the project could be delayed if either permit approval or design are delayed, or if unplanned difficulties occur during excavation or cap construction.

Groundwater Use

Groundwater use will not be significantly affected by this alternative. Disposing of Hot Spot soil off-site would significantly reduce the mobility of contaminants so that they would be less likely to move downward into groundwater. In addition, the cap would reduce the amount of rainwater which is available to mobilize remaining contaminants and cause them to move downward into the groundwater. This alternative is therefore more likely to protect the groundwater than Alternatives 1, 4 and 5, but less likely than Alternative 10.

Environmental Impact

Dust generation is expected to be higher for this alternative than for Alternatives 1 and 4, but less than Alternatives 5 and 10 because this alternative includes less on-site handling of soil. Dust control measures would be used during site clearing, grading, excavation, and construction activities to reduce generation of contaminated airborne dust. Due to the nature of asphaltic material, there would be some odor during paving of the asphalt caps. However, the level of air emissions caused by cap construction is not expected to be significantly greater than that associated with normal urban activity (such as paving streets), and should not result in significant environmental impacts. There would also be some increased noise and traffic at and near the site during the hours when site work is underway. However, the impact of noise and traffic is expected to be low because site work would be planned for daylight hours during the week when most people are away from their homes.

Justification for Rejection or Selection

This alternative would reduce both the volume and mobility of soil contaminants at the site. Most of the toxicity associated with contaminated soils would be removed from the site to another, more appropriate location. Therefore, this alternative would effectively eliminate the most significant means of human exposure to soil contaminants and environmental impacts, and thus provide adequate protection of human health and the environment.

The implementation time for this alternative is higher than Alternative 1, but about the same as Alternatives 4, 5, and 10 for this operable unit. It would cause fewer short-term environmental impacts during implementation than Alternatives 5 and 10 and would provide better protection of human health and the environment than Alternatives 1, 4, and 5. If the Hot Spot soils were removed from the site (as in this alternative), this Operable Unit would provide potential future beneficial land uses. A land use covenant and notice to the deed of the property would regulate future land use and activities on the property which might disturb soil contaminants and cause human health risks and/or adverse environmental impacts. In addition, this is the second least expensive of the alternatives for this operable unit; only Alternative 1 would cost less. Therefore, this alternative was selected as the recommended remedial alternative for Operable Unit S-3.

6.2.3.5 Alternative 10: Excavation/Off-Site Disposal of Soil Above Remedial Action Objectives

Objectives and Scope

This alternative consists of excavation and off-site disposal of the soil contaminated with lead and/or arsenic at or above the Remedial Action Objectives. After the site is cleared and construction debris disposed of off-site, excavated soil would be loaded onto either rail cars or trucks and taken off-site and disposed of in an appropriately licensed and permitted landfill. Clean soil brought from off-site would be placed in the pits created during excavation.

During construction (especially at those times when contaminated soil is being moved or otherwise disturbed), soil would be wetted down by a water truck equipped with a sprinkler attachment to minimize the amount of dust raised by these activities. Samples of air from the site and vicinity would be collected and analyzed during all construction activities. If analysis of air samples shows that dust from construction activities results in a significant risk to human health or the environment, construction would be stopped until dust generation can be mitigated.

In order to verify that the soil contaminated above the Remedial Action Objectives has been removed, soil samples would be taken from the bottom and sides of the excavation pits. The samples would be sent to a laboratory and tested for arsenic and/or lead, as appropriate. If the testing shows that there is still soil in the pits that is contaminated above the Remedial Action Objectives, excavation would continue until test results indicate that the pits have been cleaned up to the desired level.

Because this alternative provides for the removal of the soil contaminated above the Remedial Action Objectives, a fence, land use covenants, deed notices, and groundwater monitoring are not included as part of this alternative.

Cost Effectiveness

This is the most expensive alternative being considered for Operable Unit S-3. The total present worth cost of this alternative is approximately $4,270,000. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years. This includes capital costs for equipment, labor, and materials needed to accomplish excavating and disposing of the soil contaminated above the Remedial Action Objectives and all related construction activities. There would be no operation and maintenance costs associated with this alternative.

Implementation Time

The time needed to implement this alternative is expected to be seven months. This includes two months for engineering design, three months to obtain the necessary permits, and four months to clear and grade the site, excavate and dispose of the soil, and backfill the pits. It is expected that design and permitting would begin at the same time. Completion of the project could be delayed if permit approval is delayed, or if unplanned delays occur during excavation.

Groundwater Use

Groundwater use would not be affected by this alternative. Disposing of the soil contaminated above the Remedial Action Objectives would effectively eliminate contaminants that could move downward into groundwater. This alternative is therefore likely to protect the groundwater more than any of the other final candidate alternatives.

Environmental Impact

Dust generation is expected to be higher for this alternative than for all other alternatives because of the very large volume of soil that would need to be excavated and disposed of. Dust control measures would be used during site clearing, grading, excavation, and construction activities to reduce generation of contaminated airborne dust. There would also be some increased noise and traffic at and near the site during the hours when site work is underway. However, the impact of noise and traffic is expected to be low because site work would be planned for daylight hours during the week when most people are away from their homes.

Justification for Rejection or Selection

This alternative would reduce both the volume and mobility of soil contaminants. This alternative would effectively eliminate the most significant means of human exposure to soil contaminants and environmental impacts, and would thus provide adequate protection of human health and the environment.

The implementation time for this alternative is higher than Alternative 1, but about the same as Alternatives 4, 5, and 6 for this operable unit. The short-term environmental impacts would be greater for this alternative than any of the other final candidate alternatives. Although it would provide for virtually unlimited (except by zoning) future beneficial land uses, this is the most expensive of the alternatives for this operable unit. Because the potential benefits of removing the soil contaminated above the Remedial Action Objectives do not justify the significantly greater short-term environmental impacts and cost, this alternative was rejected as the recommended remedial alternative for Operable Unit S-3.

#### 6.2.3.6 Recommended Remedial Alternative

The recommended remedial alternative for Operable Unit S-3 is Alternative 6. This alternative includes excavation and off-site disposal of soils contaminated above the Hot Spot levels, constructing a specially designed asphalt cap to cover remaining soil contaminated above the Remedial Action Objectives, constructing and maintaining a fence around the site to restrict access, and repairing and replacing portions of the asphalt cap as necessary. Additionally, a land use covenant would be prepared, and a notice would be placed on the deed to the property to regulate future land uses and activities so that remaining contaminants are not disturbed.

Justification for Selection

Alternative 6 was selected as the recommended remedial alternative for Operable Unit S-3 for the following reasons:

- It would effectively eliminate the primary exposure pathways (inhalation of contaminated dust and ingestion of contaminated soil);

- It would significantly reduce downward movement of rainwater through contaminated soils, thereby providing good groundwater quality protection;

- It provides better short-term protection of human health and the environment than all other final candidate alternatives, except Alternatives 1 and 4;

- The technologies used (excavation, landfilling, and capping) are well-tested, proven and easy to implement;

- It provides adequate overall long-term protection of human health and the environment through reduction of mobility, toxicity, and volume of contaminants; and

- It is the most cost-effective of all final candidate alternatives for this Operable Unit, except for Alternative 1.

Following approval of this Remedial Action Plan, a Remedial Design Work Plan will be prepared. It will provide detailed design specifications for the recommended remedial alternative for this Operable Unit, a Site Health and Safety Plan, and an Operation and Maintenance Plan. After the Remedial Design Work Plan is prepared, it will be submitted to the DTSC for review and approval.

## Design Activities

The asphalt caps will be designed to be consistent with future potential land uses. The caps are expected to have a minimum one percent slope to provide natural drainage away from the cap. Drainage channels will be constructed as necessary to divert runoff into existing sanitary sewers surrounding the site. The engineering design of the asphalt cap would include several design documents and drawings which would be incorporated into the Remedial Design Work Plan. These documents may include the following:

- Grading design drawings;

- Asphalt cap design drawings;

- Cap construction specifications;

- Equipment and material lists; and

- Subcontractor bid and performance specifications.

Several permits are likely to be required. Some of these may include an air emissions permit from the Sacramento Metropolitan Air Quality Management District and a construction permit from the City of Sacramento Building Department.

Construction Activities

After the Remedial Design Work Plan is prepared, it will be submitted to the DTSC for review and approval. Construction activities will begin only after DTSC approval is received. Site work and construction will probably take place in the following order:

- The site will be cleared and grubbed (shrubs, trees, and debris will be removed and disposed of off-site);

- The fence that currently surrounds the site will be repaired or reconstructed as necessary to prevent unauthorized access to the site during construction activities;

- Hot Spot soils will be excavated and loaded onto either railcars or trucks for transport off-site. The transport vehicles will be covered to prevent load loss in transit;

- Clean soil (clean fill) will be brought from another location, placed in excavation pits, and graded to the appropriate surface shape so that rainwater will flow naturally off the finished cap. As the clean fill is placed in thin layers, it will be compacted using special equipment to provide a stable base for the asphalt cap;

- A layer of gravel will be placed over the soil foundation and compacted;

- Two separate layers of asphalt will be applied on top of the gravel layer. The first layer, approximately 4 inches thick, will be the base layer. The second layer, which is sometimes called a Petromat Overlay, will be approximately two inches thick and will be separated from the base layer by a special fabric and sealant. This second layer is designed to increase the life of the base layer by protecting it from wear, sunlight, and weather. This second layer is the part of the cap that will be replaced every ten years of the 30 year project life; and

- Following completion of the cap, the fence will be inspected and repaired or replaced as necessary.

In order to limit the amount of dust generated by construction activities, water will be sprayed onto contaminated soil as needed until construction has reached the point where contaminated soils are completely covered by clean fill, gravel, and/or asphalt. Air samples will be collected and tested for contaminant levels throughout excavation, backfilling, and cap construction.

## Construction Monitoring

During construction activities, the quality of the work will be periodically inspected. Several tests which are commonly used to measure compliance with contract specifications will be performed. These tests will include, but may not be limited to the following:

- Modified Proctor test (Moisture-Density relationship) of clean fill and gravel materials which are to be used in the foundation layer of the asphalt cap;

- Testing of the clean fill after it has been compacted to verify that the proper density has been achieved;

- Testing of the gravel layer after it has been compacted to verify that the proper density has been achieved; and

- Testing of the asphalt base layer after it has been compacted to verify that the proper density and thickness have been achieved;

## Health and Safety Monitoring

Site work activities will create a temporary increase in airborne dust and therefore a short-term health risk to the public. However, dust control measures and air sampling will be used to minimize the threat to site workers and the public.

Air sampling will be conducted by a trained specialist during all construction activities that might create contaminated airborne dust which could move off-site into the surrounding neighborhood. This sampling typically consists of collecting samples of airborne dust in the work area and at various other locations using high volume air samplers. Some samplers will be located upwind of the site to indicate normal background levels and others will be placed downwind of the site to capture emissions produced by the work activities. Samples will be regularly tested to assess the level of contaminated dust.

If the levels of dust or contaminants of concern (lead and/or arsenic) exceed established allowable levels, construction will be stopped and work methods modified so that airborne contaminants are reduced to acceptable levels. If the wind speed ever rises above the limit that is set in the Site Health and Safety Plan or existing permits, all construction work will stop until the wind dies down to an acceptable speed. If it becomes necessary, site workers may be required to use personal protective equipment (such as air-purifying respirators and protective suits) to prevent breathing and/or swallowing contaminated dust and to prevent contamination of clothing and skin. If necessary, signs will be posted around the site to inform the public of any safety risks.

Prior to initiation of excavation, the DTSC will be informed in writing of any additional monitoring which may be required as a result of permit restrictions. These will also be incorporated into the Site Health and Safety Plan and/or the Remedial Action Work Plan. All on-site personnel will be properly trained in accordance with the Occupational Safety and Health Act and equipped with personal protective equipment as specified in the Site Health and Safety Plan. Workers will be checked frequently during site work to verify compliance with the Site Health and Safety Plan.

Environmental Impacts

Implementation of this alternative will likely create short-term environmental impacts caused by construction activities. These impacts are expected to include increased noise on the site and in the vicinity, increased truck traffic, and odor from asphalt paving activities. However, the impact of noise and traffic is expected to be low because site work would be planned for daylight hours during the week when most people are away from their homes.

The long-term environmental benefits afforded by this alternative include eliminating off-site movement of contaminated soil in the form of airborne dust and greatly reducing infiltration of rainwater and downward migration of contaminants to groundwater. This will effectively eliminate the primary exposure pathways for people and other biological receptors.

### 6.2.4 Operable Unit S-4

#### 6.2.4.1 Alternative 1: No Action

Objectives and Scope

The National Oil and Hazardous Substances Pollution Contingency Plan requires that the No Action Alternative be considered. The amount of risk reduction provided by each of the other final candidate alternatives is compared to the No Action Alternative to assess how effective they are. This alternative involves no remediation (clean-up) of contaminated soil; it consists primarily of constructing and maintaining a fence around the entire site to prevent unauthorized access. A land use covenant would be entered into by UPRR and DTSC. The land use covenant would be noticed on the deed to the property to regulate future land uses and activities on the property which might disturb soil contaminants and cause human health risks and/or adverse environmental impacts. In addition, groundwater beneath the site would be monitored for a period of thirty years to check for changes in groundwater quality caused by the migration of contaminants in soil. A report which discusses groundwater monitoring results would be submitted to the DTSC on a yearly basis.

Cost Effectiveness

This alternative has the lowest total present worth cost of all the alternatives being considered for Operable Unit S-4. The total present worth cost of this alternative is approximately $709,000. This total includes both capital costs and Operation and Maintenance (O&M) costs. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years.

Capital costs (for equipment, labor, and materials) are approximately $6,000. This includes the cost of repairing and/or replacing the existing fence which surrounds the site. Operation and maintenance costs are approximately $1,170,000. This includes the costs for groundwater monitoring and preparation of an annual report.

Implementation Time

Since this alternative does not include any remediation of contaminated soil, the time needed to put this alternative into effect (implementation time) is expected to be approximately two and one-half months. This includes time needed to prepare a groundwater monitoring work plan, construct and/or repair the existing fence, develop the land use covenant and notice the property deed, and get DTSC approval for the work plan.

Groundwater Use

Of all the final candidate alternatives which were considered, this alternative presents the greatest risk to groundwater quality because none of the contaminated soil in S-4 would be removed or treated to reduce the level of contamination in this area. As a result, these contaminants could migrate to groundwater and thus pose a threat to human health and the environment. The thirty-year groundwater monitoring program would be designed to provide an early warning of any groundwater contamination which might occur after implementation of this alternative is complete.

Environmental Impact

Because this alternative does not include any remediation of contaminated soil, it would result in potential significant adverse environmental impacts including contaminant migration either to groundwater or off-site in the form of airborne dust. Of all the final candidate alternatives, this alternative provides the least long-term protection of the environment.

Justification for Rejection or Selection

This alternative was rejected from consideration as the recommended remedial alternative because it would not meet Remedial Action Objectives and would not provide adequate protection of human health and the environment. It would not reduce the toxicity, mobility, or volume of the contaminants at the site, nor would it eliminate the need for long-term access restrictions, land use covenants, notices to the deed, or groundwater monitoring.

6.2.4.2 Alternative 10: Excavation/Off-Site Disposal of Soil Above Remedial Action Objectives

Objectives and Scope

This alternative consists of excavation and off-site disposal of soil contaminated with lead and/or arsenic at or above the Remedial Action Objectives. Excavated contaminated soil would be loaded onto either rail cars or trucks and taken off-site and disposed of in an appropriately licensed and permitted landfill. Clean soil brought from off-site would be placed in the pits created during excavation.

During construction (especially at those times when contaminated soil is being moved or otherwise disturbed), soil would be wetted down by a water truck equipped with a sprinkler attachment to minimize the amount of dust raised by these activities. Samples of air from the site and vicinity would be collected and analyzed during all construction activities. If analysis of air samples shows that dust from construction activities results in a significant risk to human health or the environment, construction would be stopped until dust generation can be mitigated.

In order to verify that the soil contaminated above the Remedial Action Objectives has been removed, soil samples would be taken from the excavated areas. The samples would be sent to a laboratory and tested for arsenic and/or lead, as appropriate. If the testing shows that there is still soil in the pits that is contaminated above the Remedial Action Objectives, excavation would continue until test results indicate that the pits have been cleaned up to the desired level.

Because this alternative provides for removal of the soil contaminated above the Remedial Action Objectives, a fence, land use covenants, notices to the deed, and groundwater monitoring are not included as part of this alternative.

Cost Effectiveness

This is the most expensive alternative being considered for Operable Unit S-4. The total present worth cost of this alternative is approximately $155,000. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with this alternative over the next thirty years. This includes capital costs for equipment, labor, and materials needed to accomplish excavating and disposing of the soil contaminated above the Remedial Action Objectives and all related construction activities. There would be no operation and maintenance costs associated with this alternative.

Implementation Time

The time needed to implement this alternative is expected to be three and one-half months. This includes two months for engineering design, two months to obtain the necessary permits, and one and one-half months to clear and grade the site, excavate and dispose of the soil, and backfill the pits. It is expected that design and permitting would be begun at the same time. Completion of the project could be delayed if permit approval is delayed, or if unplanned delays occur during excavation.

Groundwater Use

Groundwater use would not be affected by this alternative. Disposing of the soil contaminated above the Remedial Action Objectives would effectively eliminate contaminants that could move downward into groundwater. This alternative is therefore likely to protect the groundwater more than the other final candidate alternative.

Environmental Impact

Dust generation is expected to be higher for this alternative than for the other alternative because of the volume of soil that would need to be excavated and disposed of. Dust control measures would be used during site clearing, grading, excavation, and construction activities to reduce the generation of contaminated airborne dust. There would also be some increased noise and traffic at and near the site during the hours when site work is underway. However, the impact of noise and traffic is expected to be low because site work is planned for daylight hours during the week when most people are away from their homes.

Justification for Rejection or Selection

This alternative would reduce both the volume and mobility of soil contaminants. Removing the soil from the site would reduce the toxicity of the contaminants by transferring them to a more suitable location. This alternative would effectively eliminate the most significant means of human exposure to soil contaminants and environmental impacts, and would thus provide adequate protection of human health and the environment.

The implementation time for this alternative is shorter than Alternative 1. However, the short-term environmental impacts would be greater. It would provide for virtually unlimited (except by zoning) future beneficial land uses. Because removing the soil contaminated above the Remedial Action Objectives would protect human health and the environment at a reasonable cost, with acceptable short-term impacts, and with a relatively short implementation time, this alternative was selected as the recommended remedial alternative for Operable Unit S-4.

#### 6.2.4.3 Recommended Remedial Alternative

The recommended remedial alternative for Operable Unit S-4 is Alternative 10. This alternative includes excavation and off-site disposal of the soil contaminated above the Remedial Action Objectives.

Justification for Selection

Alternative 10 was selected as the recommended remedial alternative for Operable Unit S-4 for the following reasons:

- It will effectively eliminate the primary exposure pathways (inhalation of contaminated dust and ingestion of contaminated soil);
- It provides adequate overall long-term protection of human health and the environment through reduction of mobility, toxicity, and volume of contaminants; and
- It is reasonably cost-effective.

At the direction of the DTSC, this alternative for Operable Unit S-4 was implemented as an interim remedial measure in October 1991. A Work Plan for Interim Remedial Measures on Vacant Lots adjacent to the UPRR Yard, Sacramento (Dames & Moore, 1991c) was submitted to DTSC in August 1991, reviewed by DTSC and approved in early October 1991. The Work Plan provided detailed design specifications for the recommended remedial alternative for this Operable Unit, and a Site Health and Safety Plan.

Design Activities

Very few design tasks were needed for this alternative. The only design documents and drawings were grading plans and subcontractor bid and performance specifications.

Several permits were required. These were an encroachment/excavation permit from the City of Sacramento Department of Public Works, and a construction permit from the City of Sacramento Building Department.

Construction Activities

Construction activities commenced after DTSC approval was received. Site work and construction were as follows:

- The site was cleared and grubbed (shrubs, trees, and debris will be removed and disposed of off-site);

- Soils contaminated above the Remedial Action Objectives was excavated and loaded onto railcars for transport off-site. The railcars were covered to prevent load loss in transit; and

- Clean soil (clean fill) was brought from another location, placed and graded to approximate the original contours and maintain positive drainage.

In order to limit the amount of dust generated by construction activities, water was sprayed onto the contaminated soil as needed until the excavation and load activities were completed. Air samples were collected and tested for contaminant levels during excavation and loading activities.

## Construction Monitoring

During construction activities, the quality of the work was periodically inspected. Tests which are commonly used to measure compliance with contract specifications were performed as necessary.

## Health and Safety Monitoring

Site work activities created a temporary increase in airborne dust and therefore a short-term health risk to the public. However, dust control measures and air sampling were used to minimize the threat to site workers and the public.

Air sampling was conducted by a trained specialist during all construction activities that might create contaminated airborne dust which could move off-site into the surrounding neighborhood. This sampling consisted of collecting samples of airborne dust in the work area and at various other locations using low volume air samplers. Some samplers were located upwind of the site to indicate normal background levels and others were placed downwind of the site to capture emissions produced by the work activities. Samples were regularly tested to assess the level of contaminated dust.

All on-site personnel were properly trained in accordance with the Occupational Safety and Health Act and equipped with personal protective equipment as specified in the Site Health and Safety Plan. Workers were checked prior to commencing site work to verify compliance with the Site Health and Safety Plan.

## Environmental Impacts

Implementation of this alternative were created potential short-term environmental impacts caused by construction activities. These impacts included increased noise on the site and in the vicinity, increased truck traffic, and odor from asphalt paving activities. However, the impact of noise and traffic was low because site work was conducted during daylight hours during the week when most people are away from their homes.

The long-term environmental benefits afforded by this alternative include eliminating potential off-site movement of contaminated soil in the form of airborne dust and greatly reducing infiltration of rainwater and downward migration of contaminants to groundwater. This effectively eliminates the primary exposure pathways for people and other biological receptors.

Report

A report is being prepared to summarize the removal activities. The report will include the total volume of soil removed, results of the confirmation sampling, and results of the air monitoring.

### 6.2.5 Operable Unit GW-1

#### 6.2.5.1 Alternative 1: No Action

Objectives and Scope

Consideration of the No Action Alternative is required by the National Oil and Hazardous Substances Pollution Contingency Plan. The amount of risk reduction provided by each of the other final candidate alternatives is compared to the No Action Alternative to assess how effective they are. The No Action Alternative involves no remediation (clean-up) of contaminated groundwater, nor does it include groundwater monitoring.

Cost Effectiveness

The No Action Alternative is the least expensive of the groundwater alternatives being considered for Operable Unit GW-1. There are no costs associated with this alternative.

Implementation Time

Since this No Action alternative does not consist of any activities, this alternative does not require any time to implement.

Groundwater Use

This alternative will adversely affect groundwater use at and in the vicinity of the site. Furthermore, since this alternative includes no extraction and/or treatment, contamination would continue to move off-site and may affect downgradient groundwater use which is not currently impacted.

Environmental Impact

Since there are no clean-up activities associated with this alternative, there are no short term impacts to the environment due to construction. However, this alternative may result in significant adverse environmental impacts as contaminants continue to migrate off-site. Of all the final candidate alternatives for operable unit GW-1, this alternative provides the least protection of the environment.

Justification for Rejection or Selection

This alternative was rejected from consideration as the recommended remedial alternative because it would not meet Remedial Action Objectives and would not provide adequate protection of human health and the environment. It would not reduce the toxicity, mobility, or volume of contaminants in groundwater.

6.2.5.2 Alternative 4: Extract, Treat, and Discharge

Objective and Scope

The objective of this alternative is to remove contaminated groundwater until contaminant concentrations are below Remedial Action Objectives. This alternative consists of extraction, treatment of contaminated groundwater, and discharge of treated water to the sewer, monitoring groundwater to evaluate remediation, and limiting the potential exposure to groundwater by implementing restrictions on permits for drilling of groundwater wells in Operable Unit GW-1. It also includes preparation of a report which would provide annual groundwater monitoring results and would be submitted to DTSC on an annual basis.

To remove contaminated groundwater, **extraction wells** would be placed off-site. The exact number and location of the wells is not currently known, but will be determined before completion of the Remedial Design Work Plan. For the purposes of this evaluation, it is assumed that between 2 and 10 wells may be used. If 10 wells are used, they would be pumped at 20 gallons per minute (200 gallons per minute total) and pumping would last about three years. If 2 wells are used, they would be pumped at 10 gallons per minute (20 gallons per minute total) and pumping would last about 30 years.

Extracted groundwater would be piped to a treatment system which is assumed to be located near the east central side of the site. Piping and wiring would need to be installed in a trench to connect the wells with the treatment system. Soil would be wetted during construction of the trench and treatment system foundation to minimize the amount of dust generated during construction.

In order to improve the efficiency, extend the operating life, and enhance the cost effectiveness of the treatment system, some form of pretreatment may be used. The need for and choice of **pretreatment systems** will also be influenced by the extracted groundwater. Pretreatment of extracted water would consist of either physical (such as filtering) or chemical pretreatment, depending on the quality of the extracted groundwater and the treatment system used. The type of pretreatment that may be required and associated costs cannot be specified until more data is collected on the quality of extracted water.

The treatment system may consist of an **air stripper**, which uses air to remove contaminants from the groundwater, **granular activated carbon,** which uses activated carbon to remove contaminants from groundwater, or **UV-oxidation** which uses ultraviolet light to destroy contaminants in groundwater (Figure 18). The type of treatment best suited to this task depends on a number of factors including the type and concentration of contaminants and the flow rate of water. These systems may be used independently or they may be combined to produce the best treatment at the least cost.

Air stripping basically transfers the contaminants from the water to the air in a closed system, creating a contaminant-rich air stream that is treated before it is released to the atmosphere. Treatment of the air is accomplished either through **thermal oxidation** or **carbon adsorption.** Thermal oxidation is done by either burning the contaminants or passing contaminants over a catalyst similar to a catalytic converter in a car's exhaust system. Carbon adsorption transfers contaminants from water (or air) to carbon. As more contaminants are transferred to the carbon, the pores in the carbon become full, it loses its effectiveness and must be replaced. The **spent carbon,** or carbon that has lost its ability to adsorb contaminants, is then transported off-site and recycled.

A UV-oxidation system destroys contaminants by pumping contaminated groundwater to the surface of the site, injecting chemicals such as hydrogen peroxide or ozone into the contaminated groundwater, and then exposing the water to ultraviolet light in a closed system. The chemicals help the light break down contaminants more effectively. This process produces no residuals.

After treatment, treated groundwater would be discharged to the existing City of Sacramento sewer system through a manhole near the site. This manhole is connected via underground pipeline to a wastewater treatment plant owned and operated by Sacramento County.

Cost Effectiveness

The total present worth cost of this alternative for Operable Unit GW-1 ranges from about $978,000 to $3,131,000. The total present worth cost is the amount of money that would need to be deposited into a savings account in 1991, assuming that the savings account pays five percent interest per year, to pay all costs for this alternative over the life of the project.

The least expensive system is an air stripper that treats water at a low flow (2 wells at 10 gallons per minute). This also includes treatment of the air before release to the atmosphere. The most expensive system is for UV-oxidation treatment at high flow (10 wells at 20 gallons per minute).

Capital costs are estimated to range from about $315,000 to $1,708,000 and include costs for equipment, labor, materials, and equipment installation. Operation and maintenance costs are estimated to range from about $1,163,000 to $2,382,000 and include costs for groundwater monitoring, sampling and analysis of treated groundwater, pump operation, treatment system operation, and annual reporting.

### Implementation Time

The time needed to implement this alternative for Operable Unit GW-1 is expected to be about 12 months. This includes three months to design the system, three months for DTSC review, three months to obtain construction permits, six months to obtain well permit restrictions, and three months for construction (i.e., installing groundwater extraction wells, trenching, installing piping and wiring, and installing the treatment system). It is assumed that obtaining well permit restrictions would be completed concurrently with DTSC review and approval. Completion of the project could be delayed if either permit approval or design are delayed, or if unplanned difficulties occur during construction.

### Groundwater Use

This alternative will affect groundwater use. Continuous pumping of the groundwater will lower the water table beneath the site approximately 2 to 4 feet. Pumping may also affect direction, gradient and velocity of groundwater flow. However, the concentration of contaminants will slowly drop until they are below Remedial Action Objectives. Thus, the overall long-term effects of this alternative on groundwater use will be beneficial.

### Environmental Impact

Short-term environmental impacts would occur during construction of the system and may include increased traffic congestion, noise and dust from construction equipment used to drill wells, dig trenches, and install the treatment system. Dust control measures, such as using water trucks to spray soil will be used during trenching and construction of the treatment system foundation. Noise and traffic impacts are expected to be low because work will occur during business hours when most people are away from home.

Justification for Rejection or Selection

This alternative would result in some short-term environmental impacts during construction and system operation. However, these impacts would be minor and would be out-weighed by long-term advantages of removing contaminated groundwater. Removal of contaminated groundwater would reduce the toxicity, mobility, and volume of contaminants in Operable Unit GW-1, thereby providing adequate protection of human health and the environment. This alternative uses proven technologies to extract and treat groundwater, and though this alternative is more expensive than the No Action Alternative, the extra costs are justified by the long-term benefits. Therefore, this alternative was selected as the recommended remedial alternative for Operable Unit GW-1.

#### 6.2.5.3 Recommended Remedial Alternative

The recommended remedial alternative for Operable Unit GW-1 is Alternative 4. This alternative consists of extraction of contaminated groundwater, treatment of contaminated groundwater, and discharge of treated water to the sewer. Also included with this alternative are groundwater monitoring and restrictions on the number and type of permits for the drilling of groundwater wells during groundwater remediation.

Justification for Selection

Alternative 4 was selected as the recommended remedial alternative for the following reasons:

- It will provide the greatest protection of human health and the environment;
- It will reduce the toxicity, mobility, and volume of contaminants;
- It uses proven technologies that are well tested and easy to implement; and
- Short-term impacts during construction and system operation will be minor and would be outweighed by the long-term advantages of meeting Remedial Action Objectives for groundwater.

Following approval of this Remedial Action Plan, a Remedial Design Work Plan will be prepared. It will provide detailed design specifications for the recommended remedial alternative for this Operable Unit, a Site Health and Safety Plan, and an Operation and Maintenance Plan. After the Remedial Design Work Plan is prepared, it will be submitted to the DTSC for review and approval.

### Design Activities

Design of the extraction system will include selecting the best location for extraction wells. Wells should be installed to optimize groundwater extraction but minimize impacts to the surrounding community. The location of wells will also consider the best possible route for the trench that will carry piping and wiring between off-site wells and the on-site treatment system. Also considered in the design will be the use of safeguards to prevent untreated water from accidently being discharged to the sewer and to shut the system down in the event that the flow within the sewer exceeds design capacity.

The design of the treatment system will include selecting a system of sufficient size to accommodate the flow of groundwater from the extraction wells. The engineering design of the system may include several design documents and drawings which will be incorporated into the Remedial Action Work Plan. These documents may include the following:

- Trench design drawings;
- Treatment system pad and enclosure design drawings;
- Treatment system design drawings;
- Extraction well design drawings;
- Equipment and materials list; and
- Subcontractor bid and performance specifications.

The appropriate permits will also be obtained to allow for construction of the system and for discharge of treated groundwater. These permits may include but not be limited to: building permits, well drilling permits, discharge permits (set flow rates and discharge location(s) and concentrations), air permits (if an air stripper is used), and an agreement with the City of Sacramento to permit use of the City sewer system. Additionally, well installation permit restrictions will be developed for DTSC review and approval.

### Construction Activities

After the Remedial Design Work Plan is prepared, it will be submitted to the DTSC for review and approval. Construction activities will begin only after DTSC approval is received. Construction of different parts of the system will probably be concurrent and include the following:

- Wells drilled in the appropriate locations;

- Trenches excavated, piping and wiring installed, and trenches backfilled;

- Installation of a foundation pad and enclosure for the treatment system;

- Installation of the treatment system; and

- Installation of piping to the discharge point.

Once the system is completed, it will be tested over a period of about two months to evaluate its performance. Flows from different wells may be adjusted, treated water will be sampled to make sure the system is working properly, and safeguards will be tested to ensure that they also are working properly.

## Construction Monitoring

During construction, the quality of the work will be periodically inspected. These inspections will include review of extraction well construction, trenching, treatment system foundation and enclosure construction, piping and wiring tests.

## Health and Safety Monitoring

Site work activities will create a temporary increase in airborne dust and therefore a short-term health risk to the public. Site work for groundwater remediation will not be as extensive as work required for soil remediation, however, dust control measures will be used to minimize the threat to site workers and the public, and air sampling will be used when appropriate.

Air sampling will be conducted by a trained specialist during all construction activities that might create contaminated airborne dust which could move off-site into the surrounding neighborhood. This sampling typically consists of collecting samples of airborne dust in the work area and at various other locations using high volume air samplers. Some samplers will be located upwind of the site to indicate normal background levels and others would be placed downwind of the site to capture emissions produced by the work activities. Samples will be regularly tested to assess the level of contaminated dust.

If the levels of dust or contaminants of concern (lead, arsenic, and/or asbestos) exceed established allowable levels, construction will be stopped and work methods modified so that airborne contaminants are reduced to acceptable levels. If the wind speed ever rises above the limit that is set in the Site Health and Safety Plan or existing permits, all construction work will stop until the wind dies down to an acceptable speed. If it becomes necessary, site workers may be required to use personal protective equipment (such as air-purifying respirators and protective suits) to prevent breathing and/or swallowing contaminated dust and to prevent contamination of clothing and skin. If necessary, signs will be posted around the site to inform the public of any safety risks.

Prior to initiation of site work, the DTSC will be informed in writing of any additional monitoring which may be required as a result of permit restrictions. These will also be incorporated into the Site Health and Safety Plan and/or the Remedial Action Work Plan. All on-site personnel will be properly trained in accordance with the Occupational Safety and Health Act and equipped with personal protective equipment as specified in the Site Health and Safety Plan. Workers will be checked frequently during site work to verify compliance with the Site Health and Safety Plan.

#### Environmental Impacts

Implementation of this alternative will result in short term impacts due to construction activities. These impacts are expected to include increased traffic congestion, noise and dust from construction equipment used to drill wells, dig trenches, and install the treatment system. Noise and traffic impacts are expected to be low because work will be conducted during business hours when most people are away from their homes.

### 6.2.6 Operable Unit GW-2

### 6.2.6.1 Alternative 1: No Action

#### Objectives and Scope

Consideration of the No Action Alternative is required by the National Oil and Hazardous Substances Pollution Contingency Plan. The amount of risk reduction provided by each of the other final candidate alternatives is compared to the No Action Alternative to assess how effective they are. The No Action Alternative involves no remediation (clean-up) of contaminated groundwater, nor does it include any groundwater monitoring.

#### Cost Effectiveness

The No Action Alternative is the least expensive of the alternatives being considered for Operable Unit GW-2. There are no costs associated with this alternative.

Implementation Time

Since this No Action alternative does not consist of any activities, this alternative does not require any time to implement.

Groundwater Use

As this alternative leaves the contaminated groundwater in place, groundwater use in and around the area of the contaminated groundwater would need to be limited. Over time, the contamination would move in the direction of groundwater flow, but the concentrations would decline.

Environmental Impact

Since there are no clean-up activities associated with this alternative, there are no short-term impacts to the environment due to construction. However, since this alternative does not remove and/or treat contaminants, this alternative provides the least protection of the environment of all the final candidate alternatives for Operable Unit GW-2.

Justification for Rejection of Selection

This alternative was rejected from consideration as the recommended remedial alternative because it would not meet Remedial Action Objectives and would not provide adequate protection of human health and the environment. It would not reduce the toxicity, mobility, or volume of the contaminants in groundwater.

6.2.6.2 Alternative 2: Limited Action

Objectives and Scope

The objective of the Limited Action Alternative is to provide an added measure of protection to human health beyond the No Action Alternative by monitoring groundwater and by limiting the potential exposure to contaminated groundwater by implementing restrictions on permits for drilling of groundwater wells in Operable Unit GW-2.

The Limited Action Alternative involves no remediation (clean-up) of contaminated groundwater. However, it does include monitoring groundwater for 30 years. It also includes preparation of a report which would provide annual groundwater monitoring results and which would be submitted to the DTSC on a yearly basis.

### Cost Effectiveness

The Limited Action Alternative is the least expensive of the alternatives being considered for Operable Unit GW-2. This alternative is estimated to have a total present worth cost of about $176,000. This includes only operation and maintenance costs. Operation and maintenance costs include costs for groundwater sampling, analytical tests, and preparation of an annual groundwater monitoring report for 30 years. The total present worth cost is the amount of money that would need to be deposited into a savings account in 1991, assuming that the savings account pays five percent interest per year, to pay all costs for this alternative over the next 30 years. The total present worth costs do not include the costs for permit restrictions because the costs for these restrictions are unknown.

### Implementation Time

The time expected to put this alternative into effect is about nine months. This includes three months to prepare a groundwater monitoring work plan, three months for review and approval of the work plan by DTSC, and six months to obtain well permit restrictions. It is assumed that obtaining permit restrictions would be completed concurrently with DTSC review and approval.

### Groundwater Use

This alternative leaves the contaminated groundwater in place and limits groundwater use in and around the area of GW-2. Since there is currently no known use of groundwater in GW-2, this alternative will not adversely affect present beneficial use of this resource. Furthermore, over time, the concentration of contaminants will decrease due to natural breakdown of the contaminants and dilution. The rate at which the concentrations will decrease is unknown, but since contaminant concentrations are already so low, it is expected that levels would drop below Remedial Action Objectives in a relatively short period of time so that future beneficial use of the groundwater would not be adversely affected. The groundwater monitoring program included in this alternative would monitor both the movement and concentrations of the contaminants in the groundwater over time to evaluate the reduction of the volume and toxicity of contaminants through natural degradation.

### Environmental Impact

Since there are no clean-up activities associated with this alternative, there are no short-term impacts to the environment due to construction. However, since this alternative does not remove and/or treat contaminants, of all the final candidate alternatives for Operable Unit GW-2, it provides the least protection of the environment.

Justification for Rejection of Selection

This alternative for Operable Unit GW-2 would allow for the reduction of the volume and toxicity of contaminants through natural degradation. Human health would be protected by monitoring contaminant degradation and potential migration and by limiting access to the groundwater through permit restrictions. This alternative is acceptable for this Operable Unit because of the very low levels of contaminants. It is cost-effective and would satisfy Remedial Action Objectives. Therefore, it is selected as the recommended remedial alternative.

6.2.6.3 Alternative 4: Extract, Treat, and Discharge

Objective and Scope

The objective of this alternative is to remove contaminated groundwater until contaminant concentrations are below Remedial Action Objectives. This alternative consists of extraction, treatment of contaminated groundwater, and discharge of treated water to the sewer, monitoring groundwater to evaluate remediation, and limiting the potential exposure to groundwater by implementing restrictions on permits for drilling of groundwater wells in Operable Unit GW-2. It also includes preparation of a report which would provide annual groundwater monitoring results and would be submitted to DTSC on an annual basis.

To remove contaminated groundwater, extraction wells would be placed primarily on-site. The exact number and location of the wells is not currently known, but will be determined before completion of the Remedial Design Work Plan. For the purposes of this evaluation, it is assumed that 2 wells may be used. Each well would be pumped at about 10 gallons per minute producing a total flow of 20 gallons every minute, and pumping would last for 3 years.

Extracted groundwater would be piped to a treatment system that is assumed to be located near the east central side of the site. Piping and wiring would need to be installed in a trench to connect the wells with the treatment system. Soil would be wetted during construction of the trench and treatment system foundation to minimize the amount of dust generated during construction.

In order to improve the efficiency, extend the operating life, and enhance the cost effectiveness of the treatment system, some form of pretreatment may be used. The need for and choice of pretreatment systems will also be influenced by the extracted groundwater. Pretreatment of extracted water would consist of either physical (such as filtering) or chemical pretreatment, depending on the quality of the extracted groundwater and the treatment system used. The type of pretreatment that may be required and associated costs cannot be specified until more data is collected on the quality of extracted water.

The treatment system may consist of an air stripper, which uses air to remove the contaminants from the groundwater, granular activated carbon, which uses activated carbon to remove contaminants from groundwater, or UV-oxidation which uses ultraviolet light to destroy contaminants in groundwater (Figure 18). The specific type of treatment best suited to this task depends on a number of factors including the type and concentration of contaminants and the flow rate of water. These systems may be used independently or they may be combined to produce the best treatment at the least cost.

Air stripping basically transfers the contaminants from the water to the air in a closed system, creating a contaminant-rich air stream that is treated before it is released to the atmosphere. Treatment of the air is accomplished either through thermal oxidation or carbon adsorption. Thermal oxidation is done by either burning the contaminants or passing contaminants over a catalyst similar to a catalytic converter in a car's exhaust system. Carbon adsorption basically transfers the contaminants from water to carbon. As more contaminants are transferred to the carbon, the pores in the carbon become full, it loses its effectiveness and needs to be replaced. The spent carbon, or carbon that has lost its ability to adsorb contaminants, is then transported off-site and recycled.

A UV-oxidation system destroys contaminants by injecting chemicals such as hydrogen peroxide or ozone into the contaminated groundwater once it is pumped to the surface of the site, and then exposing the water to ultraviolet light in a closed system. The chemicals help the light break down contaminants more effectively. This process produces no residuals.

After treatment, treated groundwater would be discharged to the existing City of Sacramento sewer system through a manhole near the site. This manhole is connected via underground pipeline to a wastewater treatment plant owned by Sacramento County.

Cost Effectiveness

The total present worth cost of this alternative for Operable Unit GW-2 ranges from $220,000 to $410,000. The total present worth cost is the amount of money that would need to be deposited into a savings account in 1991, assuming that the savings account pays five percent interest per year, to pay all costs for this alternative over the life of the project.

The least expensive system is an air stripper that also includes treatment of the air before release to the atmosphere. The most expensive system is for UV-oxidation treatment.

Capital costs are estimated to range from about $105,000 to $194,000. They include costs for equipment, labor, materials, and installation. Operation and maintenance costs are estimated to range from about $124,000 to $442,000. They include costs for groundwater monitoring, sampling and analysis of treated groundwater, pump operation, treatment system operation, and annual reporting.

Implementation Time

The time needed to implement this alternative for Operable Unit GW-2 is expected to be about eleven months. This includes three months to design the system, three months for DTSC review, three months to obtain construction permits, six months to obtain well permit restrictions, and two months for construction (i.e., installing groundwater extraction wells, trenching, installing piping and wiring, and installing the treatment system). It is assumed that obtaining well permit restrictions would be completed concurrently with DTSC review and approval. Completion of the project could be delayed if either permit approval or design are delayed, or if unplanned difficulties occur during construction.

Groundwater Use

This alternative will affect groundwater use. Continuous pumping of the groundwater will lower the water table beneath the site approximately 2 to 4 feet. Pumping may also affect direction, gradient and velocity of groundwater flow. However, the concentration of contaminants will slowly drop until they are below Remedial Action Objectives. Thus, the overall long-term effects of this alternative on groundwater use will be beneficial.

Environmental Impact

Short-term impacts would occur during construction of the system and may include increased traffic congestion, noise and dust from construction equipment used to drill the wells, dig trenches, and install the treatment system. Dust control measures, such as using water trucks to wet down soil, will be used during construction of the trench and treatment system foundation. Noise and traffic impacts are expected to be low because work will occur during business hours when most people are away from home.

Justification for Rejection or Selection

This alternative would result in some short-term environmental impacts during construction and system operation. Removal of contaminated groundwater would reduce the toxicity, mobility, and volume of contaminants in Operable Unit GW-2, thereby providing adequate protection of human health and the environment. However, this alternative is more expensive than the Limited Action Alternative and includes extra cost for treatment with no extra long-term benefits for groundwater use. Therefore, this alternative was rejected as the recommended remedial alternative for Operable Unit GW-2.

#### 6.2.6.4 Recommended Remedial Alternative

The recommended remedial alternative for Operable Unit GW-2 is Alternative 2. This alternative involves no remediation (clean-up) of contaminated groundwater. However, it does include permit restrictions and groundwater monitoring for a period of 30 years. It also includes preparation of a report which discusses groundwater monitoring results and which will be submitted to DTSC on a yearly basis.

##### Justification for Selection

Alternative 2 was selected as the recommended remedial alternative for Operable Unit GW-2 for the following reasons:

- It will limit the potential for exposure to contaminated groundwater;
- It will provide better short term protection of human health and the environment than other final candidate alternatives;
- Long-term effectiveness is good because of the low concentrations and limited extent of contamination; and
- It is cost effective.

##### Design Activities

The design activities for this alternative will include development of a work plan outlining the groundwater monitoring program. The work plan will be submitted to DTSC for review and approval before the start of monitoring. In addition to the work plan, well installation permit restrictions will be developed for DTSC review and approval.

##### Construction Activities

Since no system is being built and no new groundwater wells are proposed for this alternative, there will be no construction activities.

### Construction Monitoring

Since there will be no construction, there will be no construction monitoring.

### Health and Safety Monitoring

Health and safety procedures will be outlined in the Site Health and Safety Plan. All workers that collect groundwater samples will be properly trained in accordance with the Occupational Safety and Health Act and equipped with personal protective equipment as specified in the Site Health and Safety Plan.

### Environmental Impacts

Implementation of this alternative will create no environmental impacts. It is expected that this alternative will provide good long-term protection of the environment once the concentration of contaminants begins to decrease. Since this change in contamination will occur naturally, no impacts on groundwater use is expected as the result of pumping activities.

## 6.3 REGULATORY COMPLIANCE

DTSC guidelines for preparation of Remedial Action Plans (DHS, 1987), call for an evaluation of the consistency of the recommended remedial alternatives with the Health and Safety Code, and for the incorporation in the Remedial Action Plan of any applicable **Resource Conservation and Recovery Act** (RCRA) or California Code of Regulations (CCR) Title 22 technical and administrative requirements. Furthermore, the compliance of the Remedial Action Plan and the recommended remedial alternatives with the Comprehensive Emergency Response and Clean-up Liability Act (CERCLA) Section 101(24) requirements must be briefly discussed, as well as the development of a health and safety plan for remediation workers and its consistency with California Occupational Safety and Health Administration (CAL-OSHA) regulations. The following sections address these issues.

### 6.3.1 Health and Safety Code Section 25356.1(c)

Subdivision (c) of Chapter 6.8, Section 25356.1 of the Health and Safety Code states that Remedial Action Plans for sites on the Hazardous Substance Account or Hazardous Substance Clean-up Fund list must be prepared and approved in a manner consistent with Title 40 of the Code of Federal Regulations (CFR), Section 300.61 et seq (National Oil and Hazardous Substances Pollution Contingency Plan) and amendments thereto. It also states that Remedial Action Plans must consider all of the following:

- The health and safety risks posed by conditions of the site;
- The effect of contamination upon present, future, and probably beneficial uses of resources;
- The effect of alternative remedial action measures on reasonable availability of groundwater resources for present, future, and probable beneficial uses;
- The site specific characteristics including off-site migration, surface and subsurface soil and hydrogeological conditions;
- The cost effectiveness of alternative remedial action measures; and
- The potential environmental impacts of alternative remedial action measures.

The Feasibility Study (Dames & Moore, 1991b), the Supplementary Feasibility Study (Dames & Moore, 1991d), and this Remedial Action Plan have considered all of the above-mentioned factors in the detailed analyses of final candidate alternatives and the selection of the recommended remedial alternative for each operable unit.

### 6.3.2 40 CFR 260-270 and CCR Title 22 Applicable Requirements

#### 6.3.2.1 Soil Remediation

A hazardous waste treatment, storage, or disposal facility (TSDF) is defined by RCRA as a site on which hazardous waste remediation is performed or a site to which hazardous waste is removed for disposal or treatment. Remediation can be defined as those permanent removal/treatment actions taken to prevent or minimize the release of hazardous substances so that they do not cause substantial endangerment to present or future human health or welfare or the environment. Therefore, Parts 264, 265, 266, 267 and 270 of 40 CFR and Sections 66371-66391 of CCR Title 22 do not apply to the site since it is not designated as a TSDF or to the recommended remedial alternatives since they do not propose the creation of such a facility.

The Remedial Design Work Plan will describe the methods to be used to determine whether soils are classified as hazardous waste. It is anticipated that soil classification will comply with all appropriate regulatory requirements. These requirements are contained in 40 CFR Part 261 and with CCR Title 22, Section 66680-66747 in making this determination.

The Remedial Design Work Plan will also describe the actions to be taken to package, manifest, and transport soils determined to be hazardous waste. It is expected that these actions will comply with all appropriate regulatory requirements. These requirements are contained in 40 CFR Part 262 and with Sections 66428-66676 of CCR Title 22.

Section 40 of the Code of Federal Regulations Part 268 and CCR Title 22 Sections 66900 and 67702-67786 impose land disposal restrictions on certain categories of hazardous waste. Prior to landfilling these hazardous wastes, the regulations specify that wastes must be treated to meet prescribed standards. At the present time, a preliminary determination has been made that these regulations do not apply to contaminated soil at the site. This determination has been made based on the results of Toxicity Characteristic Leaching Procedure (TCLP) on soils in Operable Unit S-4.

To determine the applicability of these regulations (including potential treatment standards) to contaminated soil in Operable Units S-1, S-2, and S-3, additional analytical studies will be performed and the results of this work will be submitted to the DTSC as part of the Remedial Design Work Plan. If the contaminated soil is subject to the land ban regulations, the Remedial Design Work Plan will contain a strategy for compliance with these regulations.

#### 6.3.2.2 Groundwater Remediation

Technical and administrative requirements of 40 CFR and Title 22 of CCR which are applicable to recommended remedial alternative for Operable Unit GW-1 include the following:

- 40 CFR 262.30-34 (Pre-transport Requirements)
- 40 CFR 268.43 (Treatment standards expressed as waste concentration);
- 40 CFR 141.61 (Maximum contaminant levels for organic contaminants);
- 40 CFR 141.50 (Maximum contaminant level goals for organic contaminant);
- 40 CFR 264.601 (Environmental Performance Standards);
- 22 CCR 66392 (Permits by Rule for Transportable Treatment Unit (TTU)); and
- 22 CCR 66747 (List of Approved Treatment Process, Influent Waste Streams).

Technical and administrative requirements of 40 CFR and Title 22 of CCR which are applicable to the recommended remedial alternative for Operable Unit GW-2 include the following:

- 40 CFR 268.43 (Treatment standards expressed as waste concentration);
- 40 CFR 264.97 (General groundwater monitoring requirements);
- 40 CFR 264.98 (Detection monitoring program);
- 40 CFR 264.99 (Compliance monitoring program);
- 40 CFR 264.100 (Corrective action program);
- 40 CFR 264.101 (Corrective action for solid waste management unit);
- 40 CFR 141.61 (Maximum contaminant levels for organic contaminants);
- 40 CFR 141.50 (Maximum contaminant level goals for organic contaminant);
- 22 CCR 67210 (Applicability of Closure and Post-Closure for interim status facilities); and
- 23 CCR 25880 (Water Quality Monitoring for Classified Waste Management Unit).

The recommended remedial alternatives for both GW-1 and GW-2 have been developed and selected so as to be in compliance with all of the above-mentioned regulations. The manner in which the installation, operation and maintenance of these alternatives will comply with these regulations, will be described in the Remedial Design Work Plan.

### 6.3.3 CERCLA Section 101 (24)

Section 101 (24) of CERCLA states that the terms "remedy" or "remedial action" are those actions which are consistent with a permanent remedy taken and which prevent or minimize the release of hazardous substances so that they do not migrate or cause substantial danger to present or future health or welfare or the environment. The use of these terms in this Remedial Action Plan are consistent with this definition.

### 6.3.4 Health and Safety Plan

29 CFR Section 1910.120(i)(2) requires that a site-specific Health and Safety Plan be developed and implemented during construction and maintenance of any remediation at sites containing hazardous substances. The Health and Safety Plan must assign responsibilities, establish personnel protection standards and mandatory safety procedures, and provide for contingencies that may arise while operations are being conducted at the site. To comply with these requirements, a Site Health and Safety Plan will be developed as part of the Remedial Design Work Plan and submitted to the DTSC for review. The main components of the Site Health and Safety Plan will include:

- Names of key personnel and alternates responsible for site safety and health, and appointment of a Site Safety Officer;
- Safety and health risk monitoring during excavation, backfilling, and asphalt paving;
- Employee training assignments;
- Medical surveillance requirements;
- Frequency and types of air monitoring, personnel monitoring, and contaminant sampling techniques;
- Site control measures;
- Decontamination measures; and
- Contingency plan meeting the requirements of paragraph (1) (1) and (1) (2) of Section 29 CFR 1910.120 for safe and effective responses to emergencies including necessary personal protective equipment.

# 7.0 IMPLEMENTATION SCHEDULE

## 7.1 SOIL REMEDIATION

The implementation schedule of recommended remedial alternatives for Soil Operable Units S-1 through S-3 is presented on Figure 19. Operable Unit S-4 does not appear on the implementation schedule since activities associated with remediation of off-site contamination in this Operable Unit have been completed (see Section 6.2.4.3). The total time (i.e., from submittal of the Draft Remedial Action Plan to DTSC to end of field activities) required to implement the recommended remedial alternatives for Operable Units S-1, S-2, and S-3 is estimated to be approximately 24 months.

Remedial activities will start with the preparation of a Remedial Design Work Plan scheduled to begin immediately after approval of this Remedial Action Plan by DTSC. Preparing the Remedial Design Work Plan can be accomplished within three months. Receiving DTSC approval of the Remedial Design Work Plan will take approximately three months. Obtaining the necessary construction permits, procuring equipment, and mobilizing crews and equipment to the site can be done within three months of receiving DTSC approval of the Remedial Design Work Plan. It will require seven months for excavation, off-site disposal of Hot Spot soil and capping for Operable Unit S-2, approximately three months to implement excavation, off-site disposal of Hot Spot soil and capping of Operable Unit S-3, and approximately seven months to implement containment of Operable Unit S-1. Implementation of the containment alternative for Operable Unit S-1 cannot be completed until backfill activities are completed for Operable Unit S-2. Therefore, the implementation schedule for Operable Unit S-1 has been adjusted to be completed two months after Operable Unit S-2.

Implementation times assume 8 hours per day, 5 days per week. They also assume that an average of 2500 cubic yards of soil (3450 tons) can be excavated and hauled to an off-site disposal facility every day and that approximately 160,000 square feet of asphalt cap can be installed in a day.

It is assumed that no significant delays would result from soil sampling or analysis activities and that the type and concentration of contaminants encountered will be the same as those discovered during the Remedial Investigation. It should be noted that the occurrence of excessive emissions, permitting delays, modification of the location of staging areas or the scheduling of trucks or railcars, and the excavation of larger quantities of soil than is specified in the Supplementary Feasibility Study (Dames & Moore, 1991d) will delay the completion of excavation activities. Since several of these details will not be known until completion of the Remedial Design Work Plan, a revised schedule will be submitted to the DTSC as part of that document.

## 7.2 GROUNDWATER REMEDIATION

The implementation schedule of the recommended remedial alternatives for Operable Units GW-1 and GW-2 (groundwater remediation) is presented in Figure 20. The total time (from submittal of the Draft Remedial Action Plan to DTSC to the end of construction activities) required to implement groundwater remediation is estimated to be approximately 18 months. Design for Operable Unit GW-1 will take approximately three months. Three months will be required for DTSC review and approval of the Remedial Design Work Plan, and six months will be required for permitting and procurement of equipment. Three months will be required for construction of monitoring wells and a treatment system. Design for Operable Unit GW-2 (preparation of a groundwater monitoring work plan) will require three months, three months will be required for DTSC review and approval, and six months will be required for permitting. It is assumed in the remedial alternatives for both groundwater Operable Units that the time for permitting will commence concurrently with DTSC review and approval.

The implementation times for construction were estimated based on an 8-hour work day, 5 days per week. The construction implementation times were estimated using the following assumptions:

- 1 groundwater monitoring well installed every two days;
- 250 feet of utility trench with necessary piping and wiring installed per day; and
- 5 days for treatment system installation.

Construction implementation also assumed some of the activities listed above may occur concurrently.

It is assumed that no significant delays will be encountered during construction and that the type and concentration of contaminants encountered will be the same as those discovered during the Remedial Investigation. It should be noted that the occurrence of permitting delays or unforeseen subsurface obstacles encountered during utility trench construction will delay the completion of construction activities. Since several of these details will not be known until completion of the Remedial Design Work Plan, a revised schedule will be submitted to DTSC as part of that document.

## 8.0 NON-BINDING PRELIMINARY ALLOCATION OF FINANCIAL RESPONSIBILITY

### 8.1 INTRODUCTION

Section 25356.1 of the California Health and Safety Code states that Remedial Action Plans shall include "a non-binding preliminary allocation of responsibility among all identifiable Potentially Responsible Parties at a particular site, including those parties which may have been released, or may otherwise be immune from liability pursuant to this chapter or any other." This section of the Remedial Action Plan provides such a proposed preliminary allocation of responsibility.

California Health and Safety Code Section 25323.5 defines responsible party to mean those persons described in Section 107(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). According to CERCLA, the following parties are potentially liable for the costs of remedial actions at hazardous waste sites:

1. The owner and operator of a facility;

2. Any party who, at the time of disposal of any hazardous substance, owned or operated any facility at which such hazardous substances are disposed of;

3. Any party who by contract, agreement, or other manner arranged for disposal or treatment of hazardous substances owned or possessed by such party or by any other party or entity, at any facility owned by another party or entity and containing such hazardous substances; and

4. Any party who accepts or accepted any hazardous substances for transport or disposal; treatment facilities or sites selected by such party from which there is a release of a hazardous substance or a threatened release which causes the incurrence of response costs.

After the DTSC issues the final Remedial Action Plan pursuant to Section 253566.1(d), any Potentially Responsible Parties with aggregate alleged liability in excess of 50 percent of the costs of the removal and remedial action may convene an arbitration proceeding pursuant to Section 25356.3 by agreeing to submit to binding arbitration. If an arbitration panel is convened, any other Potentially Responsible Parties may also elect to submit to binding arbitration.

Section 25256.3(c) of the Health of Safety Code states that the arbitration panel is to apportion liability based on the following factors:

1. The amount of hazardous substance for which each party may be responsible.

2. The degree of toxicity of the hazardous substance.

3. The degree of involvement of the Potentially Responsible Parties in the generation, transportation, treatment, or disposal of the hazardous substance.

4. The degree of care exercised by the Potentially Responsible Parties, with respect to the hazardous substances, taking into account the characteristics of the substance.

5. The degree of cooperation by the Potentially Responsible Parties with federal, state, and local officials to prevent harm to human health and the environment.

## 8.2 IDENTIFICATION OF POTENTIALLY RESPONSIBLE PARTIES

Historical information indicates that the Western Pacific Railroad (WPRR) operated a railroad maintenance yard at the site commencing in 1910. From 1910 through the mid-1950s, the site was used primarily for maintaining and rebuilding steam locomotives, boilers, refurbishing rail cars, and assembling trains. During the mid-1950s, diesel engine repair and maintenance began. In 1982 UPRR acquired WPRR. UPRR discontinued railroad maintenance operations at the site in 1983, and remaining railroad maintenance buildings and structures on the site were demolished by UPRR in 1985 and 1986.

## 8.3 NON-BINDING PRELIMINARY ALLOCATION

Given that during the approximately 70 to 80 year operating history of the Sacramento Yard, WPRR owned and operated the facility for a total of at least 72 years, it is likely that WPRR generated, transported, treated and/or disposed of as much as 99 percent of the hazardous substances which are present at the site. Since UPRR owned and operated the facility for only one year, it is probable that UPRR's contribution of hazardous substances is minimal. However, WPRR as a corporate entity ceased to exist when purchased by UPRR. Therefore, UPRR is responsible for all hazardous substances at the site.

This allocation of responsibility is non-binding and preliminary. Parties assigned responsibility have various options for challenging the allocation. Based on the foregoing information, UPRR is allocated 100 percent of the financial responsibility for the hazardous substances which are at the site.

# 9.0 OPERATION AND MAINTENANCE REQUIREMENTS

## 9.1 SOIL REMEDIATION

The recommended remedial alternatives for each of the soil Operable Units in the inactive portion of the site (Operable Units S-1, S-2, and S-3) include construction of an asphalt cap to reduce off-site contaminant migration via airborne dust and infiltration of rainwater into contaminated soils. Therefore, post-construction activities associated with inspection and maintenance of this cap and groundwater monitoring will be the same, and will be performed at the same frequency for each Operable Unit. For this reason, the operation and maintenance requirements for all recommended remedial alternatives for soil remediation are discussed together below.

The recommended remedial alternative for Operable Unit S-4, which has already been implemented, involved off-site disposal of the soils contaminated above the Remedial Action Objectives and does not require any maintenance or monitoring following remediation. Therefore, the following sections do not apply to Operable Unit S-4.

### 9.1.1 Post-Construction Activities

#### Inspection

A **Site Supervisor** will be designated within 30 days of DTSC approval of the Remedial Design Work Plan. A letter which identifies the designated Site Supervisor and specifies the rationale for choosing him or her will be sent to the DTSC. This selection will be subject to DTSC review and approval.

The Site Supervisor's responsibilities will include immediately reporting to DTSC any unusual conditions, such as ponded water on the cap after rainfall, apparent cracking, or vegetation growing through the cap. The Site Supervisor will also be responsible for making sure that the entire cap is visually inspected twice each year to check for cracks or other signs of deterioration which might interfere with cap performance. He/she will be responsible for the preparation and submittal of an annual inspection report to the DTSC. This report will detail the results of the inspections, any unusual conditions discovered, and repairs undertaken (including their location and extent).

#### Maintenance

Common paving tools, methods, and materials will be used to repair the cap as needed. Unless the cap is penetrated or removed, personal protective equipment will not be required for workers conducting cap repair. However, any repairs that involve exposure to contaminated soils beneath the cap will be conducted with appropriate personal protective equipment and air sampling as specified in the Site Health and Safety Plan.

Most of the necessary crack repairs are expected to require only "cold patching" (cold asphalt). For small cold patching jobs, the patch material is typically spread using a shovel and hand-tamped. Larger cold patching jobs which involve areas of extensive cracking may require the use of larger equipment such as rollers. The purpose of the inspection program is to identify problems before they have progressed to the point where extensive repairs are needed.

Each year, one-fourth of the entire cap will be resealed using materials and methods which are commonly used to extend the life of paved surfaces such as parking lots and streets. The resealing activities will occur in rotation so that the entire cap is resealed every four years.

Replacement

The Supplementary Feasibility Study (Dames & Moore, 1991d) for this site assumed a useful life of thirty years for the cap, provided that the asphalt base layer is covered and protected by what is commonly called a Petromat Overlay. The overlay is a protective system consisting of a synthetic fabric which is glued to the asphalt base layer and is covered by a layer of asphalt approximately two inches thick. The Petromat Overlay is designed to protect the asphalt base layer from the deteriorating effects of sunlight, weather, and wear. The Petromat Overlay is expected to have a useful life of ten years when the above-described maintenance program is used. Under worst case conditions, the entire Petromat Overlay would be replaced in years 10 and 20 of the project. However, in some areas it may not be necessary to replace the entire overlay, whereas in other areas the overlay may not adequately protect the asphalt base layer and more extensive repairs may be necessary. In areas where cracking is superficial, only a portion of the overlay may need to be replaced. In other areas, deep cracking may require removal and replacement of both the overlay and base layer. It is not possible to predict how much of the cap and/or overlay can be salvaged, therefore replacement of the entire Petromat Overlay was assumed to occur in years 10 and 20 during the 30-year life of the cap.

Monitoring

A total of approximately 40 monitoring wells which exist on and near the site will be monitored for thirty years. Representative groundwater samples will be submitted to an analytical laboratory and analyzed to assess levels of the contaminants of concern. For this site, these are volatile organic compounds and petroleum hydrocarbons. It is assumed that monitoring will be conducted on a quarterly basis during the first two years, twice yearly for years three through five, and once per year for years six through thirty. An annual monitoring report will be prepared and submitted to the DTSC.

#### 9.1.2 Duration of Post-Construction Activities

For the purpose of the detailed analysis conducted for the Supplementary Feasibility Study (Dames & Moore, 1991d), a thirty-year lifetime was assumed for the asphalt cap and it was assumed that cap inspections and maintenance and groundwater monitoring would be conducted throughout this period. It was also assumed that no post-construction monitoring and maintenance activities would be required after thirty years.

#### 9.1.3 Cost of Post-Construction Activities

The total present worth cost of groundwater monitoring, cap maintenance, monitoring, and replacement, and all associated reporting for all recommended remedial alternatives for soil is expected to be approximately $1,653,000. UPRR will assume financial responsibility for this work. The total present worth cost is the amount of money that would have to be deposited into a savings account in 1991, assuming that the account earns five percent interest per year, to pay all costs associated with operation and maintenance of the remediated site over the next thirty years.

#### 9.1.4 Performance Assurance

Submittal of annual groundwater monitoring and cap inspection and repair reports to the DTSC will demonstrate that UPRR has conducted all post-construction activities in accordance with the provisions of this Remedial Action Plan.

#### 9.1.5 Future Discoveries of Contamination

If additional soil contamination is discovered at the site by UPRR, the DTSC will be notified within one week of discovery. Within one month, a written work plan which proposes methods to be used to assess the nature and areal extent of the contamination and any potential increase in health risk will be submitted to the DTSC. If necessary, plans for additional soil remediation will be submitted after the investigation is completed.

### 9.2 GROUNDWATER REMEDIATION

The recommended remedial alternative for GW-1 includes groundwater extraction, treatment and discharge. Groundwater monitoring would be conducted for the life of the alternative (3 to 30 years, depending upon pumping rate). The recommended remedial alternative for GW-2 includes no remediation, 30 years of monitoring, and restrictions on the number, location, and type of drilling permits issued for the area of groundwater contamination. Because of the differences in their approach to remediation, each of these alternatives have different operation and maintenance requirements. For this reason, they are discussed separately below.

### 9.2.1 Operable Unit GW-1

The operation and maintenance of the system used to remediate this Operable Unit will depend on the type of technology and pumping rate selected. The Supplementary Feasibility Study (Dames & Moore, 1991d) assumed the following pumping scenarios: (1) two extraction wells that produce 10 gallons per minute each over a 30-year period, and (2) ten wells that produce 20 gallons per minute each over a period of 3 years. The three technologies considered include (1) air stripping, (2) granular activated carbon, and (3) UV-oxidation.

#### 9.2.1.1 Post-Construction Activities

##### System Operation

Each well will have an electric, submersible pump to extract groundwater. It is expected that pumps may break down and need to be repaired or replaced, but it is assumed that this will occur very infrequently (such as once every five to ten years). Controls will be used to monitor the operation of each pump and of the treatment system. These will include safeguards to prevent discharge of untreated water to the sewer. In addition, any loss in pressure as a result of a leak of underground piping will automatically cause the pump to shut off.

##### System Maintenance

Use of any of the three treatment systems assumes operation 24 hours a day. After the initial start of an air stripper, maintenance would be minimal with sampling of the treated water and periodic shutdown and cleaning of the air stripper towers. Maintenance of a UV-oxidation system would include periodic cleaning and/or replacement of ultraviolet lights when they burn out. Maintenance of a granular activated carbon system would be greater than for either of the other two systems and would include replacement of used carbon on a regular basis. The carbon is contained in large vessels. One vessel would be replaced every 8 days or 80 days, depending on the flow rate from the extraction wells and when the carbon is spent.

Inspection

A Site Supervisor will be designated within 30 days of DTSC approval of the Remedial Design Work Plan. A letter which identifies the designated Site Supervisor and specifies the rationale for choosing him or her will be sent to the DTSC. This selection will be subject to DTSC review and approval.

The Site Supervisor's responsibilities will include immediately reporting to DTSC any unusual operating conditions, such as high or low pressure, burnt-out UV light bulbs, etc. The Site Supervisor will also be responsible for making sure that the treatment system is checked every time that samples of treatment water are collected. He/she will be responsible for the preparation and submittal of an annual inspection report to the DTSC. This report will detail the results of the inspections, any unusual conditions discovered, and repairs undertaken (including their location and extent).

Replacement

Although it is assumed that extraction pumps may require some periodic replacement, it is also assumed that whatever treatment system is used, its components will require minimal replacement. Replacement of one or more extraction pumps is expected to occur every 5 to 10 years.

Monitoring

This recommended remedial alternative for GW-1 involves monitoring groundwater on a regular basis. Monitoring will include collecting samples from about 30 wells that are scattered throughout the area and are located both off-site and on-site. Representative groundwater samples will be submitted to an analytical laboratory and analyzed to assess levels of the contaminants of concern. For this site, these are volatile organic compounds, and petroleum hydrocarbons. If only two extraction wells are used for 30 years, then sampling would occur quarterly for two years, then once every six months for 3 years, and then once a year for the life of the project. If 10 extraction wells are used for 3 years, then groundwater treatment is expected to last three years and groundwater sampling would occur quarterly for the full three years.

To monitor the performance of the treatment system, samples of treated water will be collected and analyzed. Treated water will be submitted to an analytical laboratory and analyzed to assess levels of the contaminants of concern, which are volatile organic compounds, and petroleum hydrocarbons. The frequency of sampling depends on the type of treatment used. For either air stripping or UV-oxidation, treated water would be sampled every week for the first three months, then sampled every month for the next three months, then sampled every three months for the next 3 or 30 years, depending on the number of wells and the flow rate which is used. Less frequent monitoring is needed over time since the air stripper and UV-oxidation system will become more efficient the longer they run.

More frequent sampling will be required for the granular activated carbon system since the efficiency of the carbon decreases over time. The sampling must occur more frequently to determine when carbon canisters are full and need to be changed. Sampling could occur as often as every four days (for flows of 200 gallons per minute) or every 15 days (for flows of 20 gallons per minute).

#### 9.2.1.2 Cost of Post-Construction Activities

The cost of the operation and maintenance of groundwater treatment depends on the type of system used and how long it operates. The present worth cost of system operation and maintenance and groundwater monitoring ranges from approximately $678,000 to $2,200,000.

#### 9.2.1.3 Performance Assurance

An annual groundwater monitoring report (a report which describes system operation and maintenance including the results of analysis of treated water) will be submitted on a yearly basis to the DTSC. These reports will demonstrate that UPRR has conducted all post-construction activities specified in this Remedial Action Plan.

#### 9.2.1.4 Future Discoveries of Contamination

If additional groundwater contamination in GW-1 is discovered by UPRR, the DTSC will be notified within one week of discovery. Within one month, a written work plan which proposes methods to be used to assess the nature and areal extent of the contamination and any potential increase in health risk will be submitted to the DTSC. If necessary, plans for additional groundwater remediation will be submitted after the investigation is completed.

### 9.2.2 Operable Unit GW-2

It is assumed that the recommended remedial alternative for GW-2 is Limited Action. This alternative includes no remediation, 30 years of groundwater monitoring, and restrictions on the number and location of wells drilled in the area of GW-2.

### 9.2.2.1 Post-Construction Activities

#### Monitoring

The primary post-construction activity associated with the recommended remedial alternative for Operable Unit GW-2 consists of groundwater monitoring for a 30-year period. The monitoring would involve collecting samples from about 10 wells that are located primarily on the southern end of the site. Representative groundwater samples will be submitted to an analytical laboratory and analyzed to assess levels of the contaminants of concern. For this site, these are volatile organic compounds and petroleum hydrocarbons. It is assumed that sampling would occur quarterly for two years, then once every six months for 3 years, and then once a year for the life of the project.

#### Inspection

A Site Supervisor will be designated within 30 days of DTSC approval of the Remedial Design Work Plan. A letter which identifies the designated Site Supervisor and specifies the rationale for choosing him or her will be sent to the DTSC. This selection will be subject to DTSC review and approval.

The Site Supervisor's responsibility will include immediately reporting to DTSC any unusual conditions, such as a cracked or broken well casing, sudden changes in concentration of groundwater contamination (increase or decrease), the presence of new and/or previous undetected groundwater contaminants, etc. The Site Supervisor will also be responsible for the preparation and submittal to DTSC of an annual report describing the results of groundwater monitoring.

#### Maintenance

Groundwater monitoring wells and/or pumps are expected to require very little maintenance. If monitoring wells are equipped with dedicated pumps for sampling, they may need periodic maintenance. However, well maintenance is expected to be limited to the infrequent repair and/or extension of casing if, during on-site soil remediation activities, equipment runs over and/or otherwise damages the top of a monitoring well. This may also happen to off-site wells, although these wells are better protected by ground surface completions with traffic boxes, and the weight and size of vehicles operating around off-site wells is likely to be much less.

Replacement

If dedicated pumps are used to collect groundwater sampling during monitoring activities, it is possible that one or more of these wells may have to be replaced during the 30-year life of the recommended remedial alternative for Operable Unit GW-2. It is also possible that once damaged by truck traffic or other heavy equipment, one or more groundwater monitoring wells would have to be replaced. If replacement of pumps and/or wells is necessary, the type, construction, and location of the new pumps and/or wells will be as similar to the original as possible. Wells which must be replaced will be abandoned according to DTSC guidelines.

#### 9.2.2.2 Cost of Post-Construction Activities

The present worth cost of post-construction activities for Operable Unit GW-2 is about $176,000 and includes groundwater monitoring at the schedule described above for 30 years.

#### 9.2.2.3 Performance Assurance

Submittal of annual groundwater monitoring reports to the DTSC will demonstrate that UPRR has conducted all post-construction activities as specified in this Remedial Action Plan.

#### 9.2.2.4 Future Discoveries of Contamination

If additional groundwater contamination is discovered in GW-2 by UPRR, the DTSC will be notified within one week of discovery. Within one month, a written work plan which proposes methods to be used to assess the nature and areal extent of the contamination and any potential increase in health risk will be submitted to the DTSC. If necessary, plans for additional groundwater remediation will be submitted after the investigation is completed.

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# 11.0 GLOSSARY

**Air Stripper** — A piece of equipment designed to remove groundwater contaminants by enhancing the circulation of an air flow through the groundwater, and thus the transport of contaminants from the groundwater to the air stream prior to final treatment.

**Analysis** — Laboratory test; also a method of determining a scientific fact.

**Applicable or Relevant and Appropriate Requirements (ARARs)** — CERCLA compliance policy which specifies that Superfund remediations meet any Federal standards, requirements, criteria or limitations that are determined legally to be applicable or relevant and appropriate requirements.

**Backfill(ing)** — Material used to fill a man-made hole or trench (such as soil, gravel, concrete); the act of placing backfill.

**Basin** — A physiographic feature or subsurface structure that is capable of collecting, storing, and discharging water by reason of its shape and characteristics of its confining material.

**Background Concentrations** — The concentrations of a specific compound in areas surrounding the site which have presumably not been affected by site activities.

**Ballast** — Coarse gravel or crushed rock laid down to form a track bed.

**Biological Receptors** — Organisms (such as people, animals and plants) that can be affected by a substance or material through exposure (breathing, swallowing, skin contact etc.).

**Bunker Fuel** — A heavy residual petroleum oil used as fuel by ships, industry, and large-scale heating and power production installations.

**By-Product** — Something produced in the making of something else.

**California Environmental Quality Act (CEQA)** — Describes the process for assessing the environmental impacts of a project.

**Capital Costs** — Costs for improvement or additions to a property.

**Carbon Adsorption** — A physical process using granular activated carbon which, because of its large surface area, has the ability to trap, and thus remove organic contaminants from groundwater.

**Claypan** — A layer of compact stiff, relatively impervious non-cemented clay.

**Clean-up** — Actions taken to deal with a release or threatened release of hazardous substances that could affect human health and/or the environment.

**Clean Fill** — A contracting term which refers to clean material (usually soil and/or gravel) used to fill a pit or raise soil elevation on a site.

**Clear and Grub** — A contracting term which refers to removal of unwanted trees, shrubs, weeds, and debris or trash from a property.

**Climatology** — The study of the statistical variations of weather behavior over many years.

**Compliance (Regulatory Compliance)** — The act of obeying a regulation or law.

**Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)** — Provides for liability, compensation, clean-up, and emergency response for hazardous substances released into the environment and clean-up of inactive hazardous waste disposal sites.

**Contaminant** — Substance which is present at a concentration greater than normal in air, soil, or water; a pollutant.

**Contaminant Mobility** — the ability of a contaminant to move through air, soil, surfacewater, or groundwater.

**Degreasers** — A solvent that removes grease from machinery or equipment.

**Demography** — The statistical study of human populations.

**Dermal Contact** — Touching or allowing the skin to come into contact with contaminated soil and/or groundwater. A type of exposure pathway.

**Downgradient** — The direction in which the elevation of the watertable declines relative to another location.

**Electromagnetic Survey** — A field investigation using an instrument which measures magnetic fields in order to locate or detect the presence of underground objects, such as tanks or drums.

**Electroplating** — Deposition of a metal alloy from a solution to the article to be plated using electrical methods.

**Exposure Pathways** — The potential means of public exposure to contaminants. These include ingestion or inhalation of, or direct contact with contaminants. Examples are water or food consumption, dust or vapor inhalation, absorption of contaminants through skin, etc.

**Extraction Well** — A groundwater well constructed with a pump used to remove or extract groundwater from the subsurface.

**Feasibility Study** — Identifies and evaluates ways of cleaning up contaminants or reducing significant health risks at a site. Various alternatives are analyzed based on a variety of criteria, including: short- and long-term effectiveness; ability to reduce the toxicity, mobility, and volume of contaminants; cost; implementation; compliance with ARARs; overall protection of human health and the environment; community acceptance; and agency acceptance.

**Final Candidate Alternatives** — Those remedial alternatives that survived screening and were selected for detailed analysis in the Feasibility Study.

**Flood Plain Deposits** — Sediments deposited adjacent to a river channel when a river overflows its banks during a flood stage.

**Flora** — Type of plants which are common to a specific region.

**Food Chain** — A succession of organisms in a community that constitutes a feeding chain in which food energy is transferred from one organism to another as each consumes a lower member and in turn is preyed upon by a higher member.

**Forbes** — Herbaceous plants other than grass growing in a field or meadow.

**Gradient** — The rate of change of the watertable per unit distance of flow at a given point in a given direction.

**Granular Activated Carbon** — Carbon which is used to decontaminate water by removing organic chemicals.

**Ground-Penetrating Radar** — An instrument which uses the reflection of high-frequency radio waves to detect underground objects.

**Groundwater Monitoring** — Laboratory tests performed on samples of groundwater (from monitoring wells) to determine the level of contaminants present.

**Habitat** — The environment in which an organism or biological population usually lives or grows.

**Hardpan** — A layer of hard subsoil or clay.

**Hazard Index** — A ratio comparing the estimated exposure to a non-cancer-causing contaminant with acceptable exposure guidelines and/or standards. If the Hazard Index exceeds a value of 1, the effect of the exposure is considered to be significant.

**Hazardous Substance** — Any material or waste that may pose a substantial present or potential threat to human health and/or the environment.

**Health Risk Assessment** — An evaluation of the risk posed by contaminants to the public. The results of this evaluation are used to assess the need for and/or type of clean-up which may be needed at a site.

**Hot Spots** — Areas/volumes of soils with the highest concentrations of contaminants.

**Hydrogeology** — The study of the interrelationship of geologic materials and processes with water.

**Interim Remedial Measures** — Clean-up actions taken to immediately reduce the potential for exposure to contaminants. Typically interim remedial measures are short-term remedies and/or small-scale clean-up measures.

**Land Use Covenant** — A document which provides information about residual contamination at a site. The document is an agreement which would be entered into by DTSC and UPRR. The agreement would have provisions to notice the deed to the property, to ensure monitoring and maintenance is conducted as required, and restrict land use as appropriate.

**Mean Sea Level** — The level of the ocean's surface, halfway between high and low tide. The elevation of mean sea level is zero.

**Medical Surveillance** — A program whereby hazardous waste workers are periodically checked to see if their health is being (or is likely to be) affected by the work environment.

**Micrograms per Deciliter** — The mass of an element or compound measured in micrograms per unit volume of fluid (blood) measured in deciliters.

**Modified Proctor Compaction Test** — A compaction test that measures the ratio of the density of soil to the soil moisture. This test is designed to simulate the unit weight of soils compacted by field methods.

**National Oil and Hazardous Substances Pollution Contingency Plan (NCP)** — Is intended to implement the response powers and responsibilities created by CERCLA.

**Natural Diversity Data Base** — A computerized data base of rare, threatened or endangered species together with the location of potential and known habitat and last known sitings. The Natural Diversity Data Base is maintained by the California Department of Fish and Game.

**Occupational Safety and Health Act** — A set of regulations stated in 29 CFR Code of Federal Regulations for general industry (Part 1910) and construction activities (Part 1926) that includes general health and safety standards for workers' protection.

**Operable Unit** — A type, volume, or area of contaminated medium which, because of its unique chemical and/or physical characteristics, can be addressed — not necessarily treated or cleaned up — most efficiently and economically as a unit.

**Operation and Maintenance** — Costs associated with activities conducted after implementation of a recommended remedial alternative to ensure that it has functioned or is functioning properly.

**Overpack Container** — Typically, a polyethylene container which is large enough to contain a 55-gallon drum. It is designed to withstand chemical degradation and is used to package drums which are leaking so that they can be shipped safely with minimal risk of a release due to handling and transport.

**Parts Per Million** — One part by weight of chemical contained in one million parts of material, for example soil.

**Personal Protective Equipment** — Clothing and equipment, such as full-face respirators and plastic coveralls and gloves, used to minimize contaminant inhalation, ingestion, and/or contact by remediation workers.

**Petroleum Hydrocarbons** — Petroleum organic compounds that contain carbon and hydrogen only.

**Petromat Overlay** — A proprietary pavement protection system consisting of a layer of synthetic fabric and asphaltic concrete which is bonded to an existing asphalt surface. It prevents damage to this surface which might be caused by sunlight, weather, and wear.

**Plume** — The portion of air or groundwater that is contaminated.

**Polycyclic Aromatic Hydrocarbons** — Consist of two or more fused benzene rings containing only hydrogen and carbon atoms.

**Potentially Responsible Party** — Any individual or company — including owners, operators, transporters, or generators of hazardous substances — potentially responsible for, or contributing to, contamination at a hazardous substances release site.

**Present Worth** — The net present worth of a series of cash flows refers to the equivalence of a single sum of money to be received or disbursed at the present time if all future receipts and disbursements over time are properly discounted to the present time and then summed.

**Pretreatment Systems** — A treatment system designed to remove gross contamination in order to increase the efficiency of the following treatment steps.

**Range** — Any series of townships of the U.S. Public Land Survey System aligned north and south and numbered consecutively east to west.

**Recommended Remedial Alternative** — An alternative for clean-up of contamination that has been recommended based on several criteria considered during an feasibility evaluation.

**Remedial Action Plan** — Document that provides information on the proposed clean-up of a contaminated site.

**Remedial Action Objectives** — Medium- and contaminant-specific clean-up goals for protecting human health and the environment.

**Remedial Design Work Plan** — Provides detailed design information and engineering specifications about the recommended remedial alternatives for clean-up of a hazardous substances release site.

**Remedial Investigation** — A study which includes the collection and analysis of soil, groundwater and air samples which assess the nature and extent of contamination at a site.

**Remediation** — Correction or clean-up of environmental contamination.

**Resource Conservation and Recovery Act (RCRA)** — Requires safe and secure procedures to be used in treating, transporting, storing, and disposing of hazardous substances.

**Risk Characterization** — The quantification of health risks associated with exposure to cancer-causing and non-cancer-causing contaminants. This is done as part of the Health Risk Assessment.

**Sediment** — Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, or ice, and has come to rest on the earth's surface.

**Site Health and Safety Plan** — A plan defining the procedures and equipment required to protect the health and safety of remediation workers during clean-up activities.

**Site Supervisor** — The person designated in the Site Health and Safety Plan who is responsible for making sure that all site visitors and workers follow the Health and Safety Plan rules.

**Slag** — The vitreous mass left as a residue by the smelting of metallic ore.

**Soil Vapor Study** — An investigative method, the objective of which is to determine the concentration or organic contaminants in vapor within soil pores. Soil gas surveys typically use soil gas probes which are inserted below ground. The gas in the probe is collected and analyzed for contaminants of concern which may have volatilized from soil and are present in gaseous form.

**Solvent** — A liquid capable of dissolving another substance.

**Spent Carbon** — Carbon which has been used up. Typically, this occurs when contaminants fill pore space within a carbon bed and there is no room for additional contaminants to be adsorbed to carbon surfaces.

**Stoddard Solvent** — A specific type of petroleum product, containing a standardized fraction of petroleum, and used as a solvent and in dry cleaning.

**Subsidence** — Localized sinking or settlement of soil which is frequently due to the removal of large quantities of groundwater from beneath the affected area over a long period of time.

**Thermal Oxidation** — An oxidation process using an elevated temperature to remove or destroy organic contaminants in a contaminant-rich air stream.

**Total Dissolved Solids** — The concentration of minerals in water.

**Township** — The unit of survey of the U.S. Public Land Survey System, representing a piece of land that is approximately 6 miles by 6 miles with a specific north/south and east/west boundary.

**Toxicity** — The harmfulness of a contaminant.

**Toxicity Characteristic Leaching Procedures (TCLP)** — A laboratory method used to determine the potential for solid contaminants or contaminants attached to soil particles to become dissolved into water.

**Trespasser** — An individual who gains unauthorized entry to the site.

**UV-oxidation** — An oxidation process using the properties of ultraviolet light to alter or destroy organic contaminants in groundwater.

**Volatile Organic Compounds** — Any of a group of organic compounds that volatilize (vaporize) at normal temperatures and pressures.

**Waste Characterization** — The act of determining what a waste material contains. May include laboratory tests or other analysis.

**Water-Bearing Zone** — a geological zone made up of gravel, sand, silt or porous rock that contains or yields water.

**Water Table** — The surface of groundwater when the pressure on the surface is equal to that of the atmosphere.

**Weedy Species** — Highly competitive plants that tend to choke out other species, and are among the first to colonize cleared land.

**Well Casing** — The slotted pipe (usually plastic or stainless steel) which is installed in a soil boring to make a groundwater monitoring well. Groundwater flows through the slots into the casing, where it can then be sampled.

## ACRONYMS

| | |
|---|---|
| ARAR | Applicable or Relevant and Appropriate Requirement |
| CCR | California Code of Regulations (California State law) |
| CEQA | California Environmental Quality Act |
| CERCLA | Comprehensive Environmental Response Compensation, and Liability Act (Federal regulations governing financial and legal responsibility for clean-up of hazardous waste sites) |
| CFR | Code of Federal Regulations |
| DTSC | California Environmental Protection Agency, Department of Toxic Substances Control |
| EPA | United States Environmental Protection Agency |
| MSL | Mean Sea Level |
| NCP | National Oil & Hazardous Substances Pollution Contingency Plan (NCP) |
| NOAA | National Oceanic Atmospheric Administration |
| NDDB | Natural Diversity Data Base |
| O&M | Operation and Maintenance |
| RCRA | Resource Conservation and Recovery Act (Federal regulations governing management of hazardous waste) |
| RWQCB | California Regional Water Quality Control Board |
| SCS | Soil Conservation Service |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TSDF | Hazardous Waste Treatment, Storage, or Disposal Facility (an EPA-defined term) |
| UPLUC | Union Pacific Land Use Committee |
| UPRR | Union Pacific Railroad Company |
| USGS | United States Geological Survey |
| UV | Ultra Violet |
| WPRR | Western Pacific Rail Road |

TABLES

**TABLE 1**
**INTERIM REMEDIAL MEASURES**
**UNION PACIFIC RAILROAD YARD**
**SACRAMENTO, CALIFORNIA**

| Date | Objectives | Scope of Activities and Results |
|---|---|---|
| 02/23/87 - 08/26/87 | Remedial activities. | Construction of a fence around the site; removal of 1,600 $yd^3$ of wood debris and soil suspected to contain asbestos; removal of 30 yds of loose material. |
| 1987 - 1988 | Dispose of contents of 2 underground concrete fuel tanks. | 72,000 gallons of black oil and sand from one tank were excavated and stock piled on site. 13,000 gallons of water and black oil from the other tank were disposed of off-site at permitted facility. Tank was steam cleaned, broken into large blocks, and stock piled on site. |
| 1988 | Dispose of Baker tank contents (oil and water). | Discharge of the top portion of tank contents to sanitary sewer under County of Sacramento permit. Remaining fluids disposed of at an off-site permitted facility. |
| 1988 | Dispose of drum contents (water produced during development of monitoring wells). | Water discharged to sanitary sewer under County of Sacramento Special Sewer Use Permit. Empty drums left on site. |
| 1988 | Dispose of drummed and stock piled soil. | Stained soil disposed of at an off-site permitted facility. Some stained soils were left stock piled on site in liner. |
| 1989 | Cleaning of 72,000-gallon underground concrete tank. | Rainwater which had collected since 1988 discharged to sanitary sewer under County of Sacramento permit. Stained soil and oily sludges disposed as California waste in an off-site permitted facility. Tank was steam cleaned. Rinsate water disposed of at an off-site permitted facility. Tank was left in place. |
| 1989 | Remove and dispose of 1,000-gallon underground storage tank. | Tank contents discharged to sanitary sewer under County of Sacramento permit. Tank was then removed and disposed of at an off-site permitted facility. |

Source: Dames & Moore, 1991b.

**TABLE 2**
**LOCATION AND USE OF GROUNDWATER WELLS**
**IN THE SITE VICINITY**
**UNION PACIFIC RAILROAD YARD**
**SACRAMENTO, CALIFORNIA**

| DWR Well No. | Depth of Completion (ft.) | Distance from Site (ft.) | Direction from Site | Current Owner | Current Use |
|---|---|---|---|---|---|
| 13m | 307 | 4,300 | West | City of Sacramento | Irrigation |
| WLP4 | 300 | 2,800 | Southwest | City of Sacramento | Irrigation |
| 14H1 | 330 | 4,700 | Southwest | City of Sacramento | Irrigation |
| 24C1 | 210 | 3,800 | Southwest | City of Sacramento | Irrigation |
| 24M1 | — | 5,700 | Southwest | — | None |
| 18Q1 | 240 | 3,000 | Southeast | CalTrans | Irrigation and Dewatering |
| 18K1 | 213 | 2,800 | East | CalTrans | Irrigation and Dewatering |
| 24A1 | 95 | 2,400 | Northeast | — | Unknown |
| FV1 | 321 | 10,900 | Southeast | Fruitridge Vista Water Company | Public Water Supply |
| FV2 | 224 | 11,600 | Southeast | Fruitridge Vista Water Company | Public Water Supply |
| FV3 | 315 | 11,100 | Southeast | Fruitridge Vista Water Company | Public Water Supply |
| FV4 | — | 9,900 | Southeast | Fruitridge Vista Water Company | Public Water Supply |
| FV5 | 320 | 9,200 | Southeast | Fruitridge Vista Water Company | Public Water Supply |
| FV6 | — | 9,300 | Southeast | Fruitridge Vista Water Company | Public Water Supply |
| FV12 | 292 | 12,200 | Southeast | Fruitridge Vista Water Company | Public Water Supply |

— Not available.
Refer to Figure 10 for groundwater well locations.
Source: Meyer, 1990; Stockton, 1990

**TABLE 3**
**SUMMARY OF BACKGROUND**
**SOIL SAMPLING - METALS**
**UNION PACIFIC RAILROAD YARD**
**SACRAMENTO, CALIFORNIA**

| Contaminant | Park Samples[1] Range (ppm) | Park Samples[1] Average (ppm) | U.S. Background Concentrations[2] Range (ppm) | U.S. Background Concentrations[2] Average (ppm) |
|---|---|---|---|---|
| Arsenic | 6.36-8.36 | 7.75 | 0.1-97.0 | 7.2 |
| Lead | 7.80-30.0 | 22.0 | 10-300 | 15.0 |
| Copper | 16.4-26.2 | 22.9 | < 1.0-700 | 25.0 |

1 Collected by Dames & Moore in Curtis Park and William Land Park.
2 Shacklette, 1984.

**TABLE 4**
**QUALITY AND BENEFICIAL USES OF**
**GROUNDWATER AND SURFACE WATER RESOURCES**
**IN THE SITE VICINITY**
**UNION PACIFIC RAILROAD YARD**
**SACRAMENTO, CALIFORNIA**

| Name of Surface (S) or Groundwater (GW) Resource | Distance From or Depth Below Site | Quality of Resource At or Beneath Site | Present Beneficial Use | Future Beneficial Use |
|---|---|---|---|---|
| Sacramento River (S) | 1 mile to the west | Not applicable; no surface water resources located at site. | Municipal and domestic supply, irrigation, contact and non-contact recreation, freshwater habitat and navigation. | Municipal and domestic supply, irrigation, contact and non-contact recreation, freshwater habitat and navigation. |
| American River (S) | 2 miles to the north | Not applicable; no surface water resources located at site. | Municipal and domestic supply, irrigation, industrial service supply, industrial power supply, contact and non-contact recreation, freshwater habitat/ spawning/migration for warm and dold-water fish and wildlife habitat. | Municipal and domestic supply, irrigation, industrial service supply, industrial power supply, contact and non-contact recreation, freshwater habitat/ spawning/migration for warm and dold-water fish and wildlife habitat. |
| Sacramento River Basin (GW) | 21 to 35 feet below surface of site | Moderate total dissolved solids; moderately hard | Irrigation, dewatering within a one-mile radius, public water supply, approximately 2 miles to the southeast. | Community and military water systems, domestic use. |

Source: RWQCB, 1991; USGS, 1985.

**TABLE 5**
**BIOLOGICAL RECEPTORS**
**SUMMARY OF NATIONAL DIVERSITY DATABASE**
**UNION PACIFIC RAILROAD YARD**
**SACRAMENTO, CALIFORNIA**

| Species | Approximate Distance to Nearest Siting (miles) | Cover | Food/Foraging Habits |
|---|---|---|---|
| Swainson's Hawk | 3.5 | Oak savannah, roosts in large trees, but will roost on ground if none available. | Forages in grasslands or adjacent grain or alfalfa fields. Eats mice, gophers, ground squirrels, rabbits, large arthropods, amphibians, reptiles, birds, and rarely fish. |
| Yellow-billed Cuckoo | 5.9 | Densely foliaged, deciduous trees and shrubs, especially willows, required for roosting. | Gleans large insects from foliage. |
| Burrowing Owl | 2.0 | Rodent or other burrows for roosting and nesting cover. | Mostly insects, also small mammals, reptiles, birds, and carrion. |
| Bank Swallow | 3.2 | Holes in cliffs in river banks for cover. Frequents near bodies of water. | Forages by hawking insects during long gliding flights. Feeds predominantly over open riparian areas, but also over brushland, grasslands, and cropland. |
| Tricolored Blackbird | 4.3 | Breeds near emergent wetlands, especially areas with cattails, and tules, also in trees and shrubs. | Feeds on insects, seeds, and cultivated grains. Forages on ground in croplands, grassy fields, flooded land, and along edges of ponds. |
| Valley Elderberry Longhorn Beetle | 3.2 | Found only in Elderberry Savannah. | Larvae are borers, adults feed on foliage. |
| Dwarf Downinga | 8.5 | Flowering plant species associated with vernal pools. | Needs conditions required for vernal pools. |

Source: Zeiner *et al.*, 1990.

# TABLE 6
# REVISED BASELINE HEALTH RISK ASSESSMENT SUMMARY
# UNION PACIFIC RAILROAD YARD
# SACRAMENTO, CALIFORNIA

| Land Use | Exposed Populations | Estimated Lifetime Cancer Risk | Chemicals Associated with Highest Risks | Major Exposure Pathways | Noncancer Hazard Indices | Chemicals with Hazard Indices Exceeding 1.0 |
|---|---|---|---|---|---|---|
| Current Land Use | Trespasser | $2.0 \times 10^{-4}$ | Arsenic | Soil Ingestion, Inhalation | $<1$ | |
| | Off-site Resident - Adult | $8.5 \times 10^{-5}$ | Arsenic | Inhalation | $<1$ | |
| | Off-site Resident - Child | $3.8 \times 10^{-4}$ | Arsenic | Inhalation | $<1$ | |
| Future Land Use | Off-site Resident - Adult | $8.1 \times 10^{-4}$ | Arsenic<br>1,1-Dichloroethene | Inhalation<br>Inhalation during Showering, Ground Water Ingestion | $<1$ | |
| | Off-site Resident - Child | $2.4 \times 10^{-3}$ | Arsenic<br>1,1-Dichloroethene | Inhalation<br>Ground Water Ingestion | $<1$ | |
| | On-site Resident - Adult | $2.5 \times 10^{-3}$ | Arsenic<br>1,1-Dichloroethene<br>Benzene | Ground Water Ingestion, Soil Ingestion<br>Inhalation during Showering, Ground Water Ingestion<br>Inhalation during Showering, Ground Water Ingestion | $<1$ | |
| | On-site Resident - Child | $7.3 \times 10^{-3}$ | Arsenic<br>1,1-Dichloroethene<br>Benzene | Ground Water Ingestion, Soil Ingestion<br>Ground Water Ingestion<br>Ground Water Ingestion | $>1$ | Antimony, Arsenic, Copper, Naphthalene, Thallium, Zinc |

**TABLE 7**
**VOLUMES OF AFFECTED SOILS**
**ABOVE REMEDIAL ACTION OBJECTIVES AND HOT SPOT LEVELS**
**UNION PACIFIC RAILROAD YARD**
**SACRAMENTO, CALIFORNIA**

| Target Chemicals/ Materials | 0-0.5 | 0.5-1.5 | 1.5-5 | 5-10 | 10-15 | 15-20 | Bulk | Total Cubic Yards |
|---|---|---|---|---|---|---|---|---|
| **Soil Operable Unit S-1** | | | | | | | | |
| **VOLUME ABOVE RAOS (IN CUBIC YARDS)** | | | | | | | | |
| As ≥ 8mg/kg | 20,000 | 21,700 | 14,200 | 17,900 | — | — | — | 73,800 |
| Pb ≥ 190 mg/kg | 10,300 | 4,400 | 2,200 | 700 | — | — | — | 17,600 |
| **VOLUME ABOVE HOT SPOT LEVELS (IN CUBIC YARDS)**** | | | | | | | | |
| As ≥ 75 mg/kg | 1,400 | 1,000 | 900 | — | — | — | — | 3,300 |
| Pb ≥ 500 mg/kg | 2,900 | 2,000 | 600 | — | — | — | — | 5,500 |
| **Soil Operable Unit S-2** | | | | | | | | |
| **VOLUME ABOVE RAOS (IN CUBIC YARDS)** | | | | | | | | |
| As ≥ 8 mg/kg | 1,700 | 2,200 | 15,600 | 17,100 | — | — | — | 36,600 |
| PB ≥ 190 mg/kg | 700 | 800 | 10,000 | 3,200 | — | — | — | 14,700 |
| TPH* | 70 | | 5,600 | 4,900 | 1,000 | — | — | 11,570 |
| PAH*** | NA | NA | NA | NA | NA | NA | NA | NA |
| Drums | — | — | — | — | — | — | 400 | 36 |
| **VOLUME ABOVE HOT SPOT LEVELS (IN CUBIC YARDS)**** | | | | | | | | |
| As ≥ 75 mg/kg | 40 | — | 2,700 | — | — | — | — | 2,740 |
| PB ≥ 500 mg/kg | 110 | 70 | 6,100 | 1,500 | — | — | — | 7,780 |
| TPH* ≥ 15,000 | 70 | | 1,700 | 1,100 | — | — | — | 2,870 |
| **Soil Operable Unit S-3** | | | | | | | | |
| **VOLUME ABOVE RAOS (IN CUBIC YARDS)** | | | | | | | | |
| As ≥ 8 mg/kg | 2,900 | 200 | 12,000 | 700 | — | — | — | 15,800 |
| Pb ≥ 190 mg/kg | 1,700 | 200 | 900 | — | — | — | — | 2,800 |
| TPH* | 120 | | — | — | — | — | — | — |
| **VOLUME ABOVE HOT SPOT LEVELS (IN CUBIC YARDS)**** | | | | | | | | |
| As ≥ 75 mg/kg | 100 | — | — | — | — | — | — | 100 |
| Pb ≥ 500 mg/kg | 20 | — | — | — | — | — | — | 20 |
| **Soil Operable Unit S-4** | | | | | | | | |
| **VOLUME ABOVE RAOS (IN CUBIC YARDS)** | | | | | | | | |
| As ≥ 8 mg/kg | 600 | | NA | NA | NA | NA | NA | 600 |
| Pb ≥ 190 mg/kg | | | NA | NA | NA | NA | NA | |
| **VOLUME ABOVE HOT SPOT LEVELS (IN CUBIC YARDS)** | | | | | | | | |
| As ≥ 75 mg/kg | NA | NA | NA | NA | NA | NA | NA | NA |
| Pb ≥ 500 mg/kg | NA | NA | NA | NA | NA | NA | NA | NA |

**TABLE 7**
**VOLUMES OF AFFECTED SOILS**
**ABOVE REMEDIAL ACTION OBJECTIVES AND HOT SPOT LEVELS**
**UNION PACIFIC RAILROAD YARD**
**SACRAMENTO, CALIFORNIA**
**(Continued)**

Legend:

NA — Not Applicable

As — Arsenic

Pb — Lead

TPH — Total Petroleum Hydrocarbons

* — TPH remedial action objective and definition is depth-dependent (see Table 13). TPH hot spot level is 15,000 mg/kg. This concentration represents the level at which TPH may move freely in soil without consideration of infiltration.

** Reader should note that overlap may occur between hot spots and other areas where RAOs for Pb, As and TPH are exceeded; contour maps should be used for cross reference.

*** The data for PAH contamination is currently insufficient to estimate the volume of PAH-contaminated soil above RAOs.

— None detected.

**TABLE 8**
**SOIL OPERABLE UNIT AREAS AND VOLUMES**
**UNION PACIFIC RAILROAD YARD**
**SACRAMENTO, CALIFORNIA**

| Name of Operable Unit | Surface Area ($ft^2$) | Acres | In-Situ Volume ($yd^3$) |
|---|---|---|---|
| S-1 | 1,143,300 | 27 | 94,700 |
| S-2 | 246,800 | 6 | 48,200 |
| S-3 | 206,000 | 5 | 16,900 |
| S-4 | 9,550 | 0.2 | 600 |
| S-5 | To be determined | To be determined | To be determined |

Source: Dames & Moore, 1991.

Note: The nature and extent of contamination in Operable Unit S-5 has not been evaluated. Investigations will be conducted in this area in the future.

$ft^2$ = square feet
$yd^3$ = cubic yards

## TABLE 9
## GROUNDWATER OPERABLE UNIT AREAS AND VOLUMES
## UNION PACIFIC RAILROAD YARD
## SACRAMENTO, CALIFORNIA

| Operable Unit | Area (Acres) | Thickness[1] (feet) | Porosity[1] (%) | Volume | |
|---|---|---|---|---|---|
| | | | | ($Ft^3$) | Gallons |
| GW-1 | 35.4 | 20-35 | 25-30 | $19.4 \times 10^6$ | $145 \times 10^6$ |
| GW-2 | 4.5 | 15 | 30 | $0.89 \times 10^6$ | $6.6 \times 10^6$ |

[1]Source: Dames & Moore, 1991f.

Note: The total volume of groundwater to be removed during groundwater remediation is likely to be 2 to 5 times the volume of each operable unit. This occurs because the contaminated groundwater cannot be selectively removed.

**TABLE 10**
**SUMMARY AND COMPARISON**
**SOIL ALTERNATIVES**
**UNION PACIFIC RAILROAD YARD**
**SACRAMENTO, CALIFORNIA**

| Operable Unit | Alternative | Short-term Effectiveness | Long-term Effectiveness | Reduction of T,M,V | Implement-ability | Cost* | Compliance with ARARs | Overall Protection of Public Health and Environment | State Acceptance | Community Acceptance |
|---|---|---|---|---|---|---|---|---|---|---|
| S-1 | 1 | Fair | Poor | Poor | Fair | $803,000 | Poor | Poor | Unknown | Unknown |
| | 4 | Fair | Good | Fair | Good | $4,748,000 | Good | Good | Unknown | Unknown |
| | 5 | Fair | Good | Good | Fair | $9,181,000 | Good | Good | Unknown | Unknown |
| | 6 | Fair | Good | Fair | Good | $6,301,000 | Good | Good | Unknown | Unknown |
| | 10 | Poor | Good | Fair | Fair | $19,197,000 | Good | Good | Unknown | Unknown |
| S-2 | 1 | Fair | Poor | Poor | Fair | $731,000 | Poor | Poor | Unknown | Unknown |
| | 6 | Fair | Good | Fair | Good | $4,501,000 | Good | Good | Unknown | Unknown |
| | 10 | Poor | Good | Fair | Fair | $11,247,000 | Good | Good | Unknown | Unknown |
| S-3 | 1 | Fair | Poor | Poor | Fair | $753,000 | Poor | Poor | Unknown | Unknown |
| | 4 | Fair | Good | Fair | Good | $1,480,000 | Good | Good | Unknown | Unknown |
| | 5 | Fair | Good | Good | Fair | $845,000 | Good | Good | Unknown | Unknown |
| | 6 | Fair | Good | Fair | Good | $804,000 | Good | Good | Unknown | Unknown |
| | 10 | Poor | Good | Fair | Fair | $4,270,000 | Good | Good | Unknown | Unknown |
| S-4 | 1 | Poor | Poor | Poor | Poor | $709,000 | Poor | Poor | Unknown | Unknown |
| | 10 | Poor | Good | Fair | Good | $155,000 | Good | Good | Good | Good |

* Net present worth cost of the alternative in 1991 dollars as calculated over a 30-year span using a 5% interest rate.

Note: State and community acceptance of alternatives is currently unknown. Additional information on this issue will become available during and after the State's review of the RI/FS Addendum.

Alternative 1 — No Action.
Alternative 4 — Containment with Institutional Controls
Alternative 5 — Excavation/On-Site Treatment of Hot Spots with Capping
Alternative 6 — Excavation/Off-Site Disposal of Hot Spots with Capping
Alternative 10 — Excavation/Off-Site Disposal of Soil Above Remedial Action Objectives

**TABLE 11**
**SUMMARY AND COMPARISON**
**GROUNDWATER ALTERNATIVES**
**UNION PACIFIC RAILROAD YARD**
**SACRAMENTO, CALIFORNIA**

| Operable Unit | Alternative | Short-term Effectiveness | Long-term Effectiveness | Reduction of Toxicity, Mobility and Volume | Implementability | Cost* | Compliance with ARARs | Overall Protection of Human Health and Environment | State** Acceptance | Community** Acceptance |
|---|---|---|---|---|---|---|---|---|---|---|
| GW-1 | 1 No Action | Poor | Poor | Poor | Fair | 0 | Poor | Poor | Poor | Unknown |
| | 4 Extract/ Treat/ Discharge | Good | Good | Good | Good | $978,200 - $3,131,300 | Good | Good | Unknown | Unknown |
| GW-2 | 1 No Action | Poor | Poor | Poor | Fair | 0 | Poor | Poor | Poor | Unknown |
| | 2 Limited Action | Fair | Good | Fair | Fair | $175,700 | Fair | Good | Poor | Unknown |
| | 4 Extract/ Treat/ Discharge | Good | Good | Good | Good | $220,400 - $410,000 | Good | Good | Unknown | Unknown |

* When range of costs is presented for GW-1, lower cost = 2 wells pumping at 10 gpm each for 30 years. Higher costs = 10 wells pumping at 20 gpm each for 30 years. For GW-2, lower cost is for air stripping; higher cost is for UV/Oxidation.

** The ability of each alternative to satisfy these criteria will not be known until State review of the RI/FS Addendum.